

A Study on Recent Advancements and Techniques of Forensic Science in Criminal Justice System

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Abstract - Since its beginnings in the early 1800s, forensic science has evolved tremendously. This includes the development of new fields like DNA identification and digital forensics, which are quickly changing the landscape for how crimes are investigated. Forensic science & technology is a systematic technique that is used to research any type of evidence, together with weapons, capsules, chemicals, biological fluids, and other substances left at the scene. It is one of the maximum essential branches of crook law. It contributes to our felony and gets which means setting up guilt and innocence in any crime & additionally facilitates us apprehending what occurred for the duration of the crime and why it passed off. It is also described as the application of a wide spectrum of sciences to question-answer in crook and civil law. This consists of the utility of chemistry, medicine, physics, and arithmetic. Analyze crime scenes, accumulate evidence, and solve crimes. The primary method to detect lines of bloodstains at the scene placed on articles or objects is microscopy. The blood grouping is then determined by using Serology testing.

Keywords - Criminal Investigation, Forensic Science, Investigation, Criminal law.

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INTRODUCTION

In India, forensic scientists have helped solve ever all high-profile cases including terrorism, homicide, kidnapping, and others which might be enforced via governmental groups like Police, Crime Investigation Department (CID), etc.

India has always been interested in forensic science and its potential for use in law enforcement and criminal justice. The first Indian professional in the field of Forensic Science was Dr. Bishan Charan Pal, who established the first forensic laboratory in India in 1893-94. Forensics play a significant role in our lives by contributing to most of today's technological advancements, including DNA testing. As crime rates seem to be on the rise and investigations become more complicated, the need for forensics is ever increasing. Since the advancement of technology and increased education, there have been many changes to the way forensic science is handled. Today, there are many new developments concerning forensic sciences, like DNA Analysis and Fingerprints Analysis.

Assembly of these machines in laboratories is overseen by the Forensic Science Laboratory (FSL) which has been granted an autonomous status under the new law "the FSL Act, 2017". The situation topics of forensic technological know-how are very substantial as it includes numerous regions, for instance, DNA assessment, fingerprint, autopsies, pathology, toxicology, and many others, which help in figuring out the motive of death and the link between the suspect.

Furthermore, Forensic evidence is a discipline that works therefore with the parameters of the Indian criminal device. Its function is to provide the path to those sporting out criminal research and to offer the best facts to the judges upon which they're able to have complete keep in mind in figuring out criminal as well as civil disputes. In present-day instances, Forensic science is a notably advanced scientific way this is applied in each criminal and civil investigation. It incorporates all extraordinary medical strategies consisting of fingerprint assessment, DNA evaluation, ballistics and explosives, firearms, and many others.

Forensic science is a fast-evolving branch of study that may be very useful in criminal cases. Technical

skills are used in forensic science to locate, identify, and convict criminals. In India and other areas of the globe, forensic technology is becoming increasingly widely used and understood by law enforcement organizations. Only by adopting a new professional culture, scientific process, and equipment, as well as enhanced training inputs and the development of forensic labs, can forensic technology investigations be conceivable. In today's world, when sophisticated science and technology are being generated and new studies are being performed in every subject, these contemporary technologies have provided the world with an effective and precise instrument for criminal investigation. While modern technology and methodologies are rapidly changing the field of forensic science, scientific evidence offers the enticing promise of extremely accurate fact discovery and a reduction in the uncertainty that typically accompanies judicial decision making.

Traditional methods have not proven to be very effective in achieving the required conviction rates, but in recent years, the application of forensic technology knowledge and techniques has resulted in a rise in higher rates of conviction for various crimes and the investigation of a criminal case for justice. Our society's pattern has altered as a result of the development of science and technology to keep up with day-to-day progress. Although the Indian government has built a few forensic science labs in various parts of the country, it may be advised that mobile laboratories be built in remote areas as well, so that they may go to the crime scene as fast as feasible. Another potential option is to teach cops and investigators the fundamental ideas and principles so that evidence may be obtained and criminal records can be properly kept. The investigator and police officers should be instructed on how to handle evidence appropriately and how to gather a large amount of evidence from the crime scene in such a way that the sample's original condition is preserved until it reaches the forensic laboratory.

CONSEQUENCES AND A SOCIO-LEGAL ANALYSIS

Science has a huge influence on our daily life. Everything is changing as science and technology are used in criminal detection and investigation, as well as in the administration of justice across the globe. Scientists are using DNA sequencing, drug testing, and Automated Finger Identification Technology to repeat the crime and error in the field of forensic science, which is continually expanding owing to fresh technology and techniques. Modern forensic methods can distinguish trace elements and organic components down to a few hundred molecules. When used with prudence, these cutting-edge technologies have the ability to uncover hidden crimes, punish the guilty, and exonerate the innocent. It also played a number of functions in identifying victims of crime, mishaps, disasters, and death, as well as providing real assistance to grieving survivors.

The current situation shows the impact of science and technology on the legal domain, with the guardian of the law relying on a variety of scientific approaches and accomplishments to combat crime. Forensic technology, on the other hand, is utilised to solve criminal cases and gives answers via comparisons with control chemicals and biological evidence collected at the crime scene. Furthermore, forensic technology may be used to determine the required answers for such criminal examinations by using trace evidence and impression proof such as finger prints, tyre tracks, and footwear imprints. Aside from that, forensic science covers a wide range of subjects, such as forensic accounting, which is the study and analysis of accounting evidence used to resolve disputes.

Criminals could not have been convicted of their crimes, which varied from petty theft to a murderous rampage, without the aid of forensic science unless an eye witness was present at the crime scene. In today's world, science is fortunately employed to solve crimes, and offenders' left-behind clues may be tracked back to them using scientific proof. Forensic science is important in the legal system because it deals with the application of scientific knowledge and methods to legal issues. The criminal investigation puzzle would be complete without forensic technologies. Using forensic tools, police have been able to limit down suspects by recognising a criminal pattern and personality. The importance of forensic science in the prosecution of criminal defendants is recognised by the legal system, which places a premium on quick and high-quality crime scene management. This increases the precision with which crimes are recognised, potentially increasing the rate of conviction.

FORENSIC TECHNOLOGY IN INDIAN CRIMINAL INVESTIGATIONS

There is no need to introduce it as we have often encountered its use in popular television shows & series such as Criminal Minds, Crime patrol & CID. & Many Movies & Web series.

Criminal profiling permits forensic scientists to 0 down on suspects via determining a criminal's patterns and persona. It is based totally on a psychological evaluation of the assets seized from an offender. This facilitates drawing a complete social and mental assessment of the culprit. Although it's far often wondered for its accuracy, effectiveness, and medical validity, its function in a crook investigation can be not noted.

The primary steps of crook profiling consist of an in-intensity evaluation of the crime scene, reading the incidence and drawing comparisons with similar events in the past, assessment of the victim's historical past and sports, considering all viable motives, and getting ready a detailed description of the suspects to compare it with preceding cases.

In India, forensic science became well known after the murder case of Prime Minister Indira Gandhi in 1984. There was no other way to find out who killed her because all gunshots came from one location. The security guard who was supposed to have been standing right next to her could not be tracked down either. Anyway, it was only possible to track him down through fingerprints that were on some glasses left at the crime scene.

Forensic technology is the application of science. It helps to establish clues, provide evidence and find answers for law enforcement, attorneys, historians, and many other people who need to do their jobs. A person who uses these techniques is called a Forensic Scientist. Forensic science is a mixture of different sciences and skills like biology, chemistry, physics, engineering, computer science, etc. It also includes forensic psychology and sociology which are used to investigate cases. The use of forensic technology has evolved in recent years, and it has become a particularly important part of criminal investigations. The Indian criminal justice system is no different when it comes to the use of forensic technology in the pre-trial process. There are various stages at which these methods are utilized by investigators, such as crime scene management, collection and preservation of evidence, interrogations, and finally court proceedings.

Forensic technology can also be used for a variety of purposes such as identifying victims or suspects, reconstructing events, or locating missing people or goods. These methods may be used by soldiers on battlefields too to identify. Forensic era is vital in criminal investigations because it allows us to pick out and reconstruct the crime scene. It also facilitates locating evidence and conducting a put-up-crime analysis. It performs a crucial function inside the justice machine.

Forensic technological know-how is that offers methods for accumulating, maintaining, analyzing, interpreting and offering evidence from a criminal offense or an accident which will adjudicate felony subjects and public protection issues. The excellent instance of forensic technology is DNA profiling or fingerprinting, which has been used inside the for a long time for fixing crimes. Criminal justice refers to those sets of approaches with the aid of which societies assert manipulation over human beings who've committed crimes or rule breaking in an effort to make certain there are truthful outcomes for their actions and that most of the people's confidence. Forensic science, specially in criminal investigation, has been a hastily developing subject due to the quantity of technology and research that has been committed to it. Specifically inside the area of criminal investigation, is a continuously changing terrain. Innovative technologies are being developed at an alarming fee and they promise to revolutionize how we conduct investigations and ultimately resolve crimes.

It is the application of a range of physical and herbal sciences to criminal and civil law. Criminal justice is the adjudication of people who have been accused of violating the law. Criminal regulation is the body of regulation which defines what constitutes against the law or an act punishable by regulation and units out punishments for convicted offenders.

FEATURING MAIN TOOLS OF CRIMINAL INVESTIGATION

Fingerprinting - This method is used to perceive a person through the pattern of their fingerprints. It is achieved by taking a fingerprint and comparing it with those on record.

Serology - This method is used to discover human beings by using blood, saliva, semen, hair, or different organic materials found at a criminal offense scene.

Polygraph Exam - This method measures and information physiological responses which includes coronary heart fee, respiratory charge, and adjustments in perspiration at the same time as being wondered.

Voice Analysis - This method analyzes sounds like tape recordings or audio from video to determine whether a person's voice suits that of a speaker at the tape

FEATURES OF FORENSIC SCIENCE IN CRIMINAL LAW

Forensic scientists can be found in several institutions such as crime laboratories, examining magistrates, and surveyors. Agencies like the Federal Bureau of Investigation (FBI), forensic scientists perform a variety of duties related to crime investigation including crime scene processing, evidence analysis, examination, and reconstruction.

Forensic science is the utility of medical principles to criminal investigations. The objective of forensic technology is to offer irrefutable evidence that identifies who, what, wherein, while, and how against the law happened. Forensic scientists are highly knowledgeable professionals within the field of crook justice. They use a wide variety of strategies and technology to analyze evidence from crime scenes. Forensic scientists gather, identify and hold bodily proof at crime scenes by using gear consisting of microscopes, chemicals, take a look at kits, police tape, and cameras. They additionally use DNA trying out strategies to identify individuals in instances wherein biological material has been determined on the scene of a criminal offense or on any private property belonging to sufferers or perpetrators alike.

The forensic proof is bodily evidence that can be inspected, tested, and relied upon by an expert to assist shape an opinion on or provide assistance to truth at trouble in a crook, civil or disciplinary case. It can talk to any form of fabric that is delivered into

proof, which includes any object or result produced via scientific methods in the laboratory. In decades beyond, forensic experts relied in most cases on identifying fingerprints and blood-type analysis as the maximum beneficial type of proof. Today this class has expanded notably to consist of hair samples and DNA samples taken from a crime scene.

For forensic proof in courtroom complaints to be admissible, it should meet two conditions: it ought to be applicable and reliable. The relevant manner is that there desires to be a few connections between the given piece of put up-crime proof.

CHARACTERISTICS OF FORENSIC SCIENCE IN CRIME INVESTIGATION

The forensic area is the application of technological knowledge to reply to questions of interest to the prison device. Forensic scientists inspect proof that may assist in determining who dedicated a crime, what befell at the crime scene, and other elements of the event. The area has grown exponentially over time with the improvement of recent innovations like DNA sequencing, the brain-imaging era, digital pictures, lasers.

Forensic scientists rely upon a ramification of clinical disciplines including chemistry, biology, toxicology, entomology (the look at bugs), materials engineering, and environmental sciences which includes geography, ecology, and geomorphology.

Forensic technological ability operates as one element of criminal justice and plays an essential position in fixing crimes, offering duty for perpetrators, and identifying patterns amongst those crimes. The unique techniques and techniques for supplying forensic proof are rooted in Western analytical chemistry (suppose Sherlock Holmes) and the evaluation of not unusual substances observed at crime scenes. This remains the spine of forensic analysis these day.

ROLE OF COMPUTER FORENSICS IN CRIME INVESTIGATION

The goal of a computer forensic is to collect evidence from a computer. This information can be used to uncover the truth and find out if the suspect committed the crime. The profession requires extensive knowledge of computers, software, and operating systems.

The field of computer forensic science is a branch of forensic investigation. It includes the recovery and analysis of data from computers, smartphones, and other digital devices.

The scope of computer forensics is broad and can be used in several types of investigations - such as drug trafficking, terrorism, corporate espionage, or theft.

Role of computers in forensic technological expertise investigation is to collect and examine facts from diverse assets. Computers gather facts from crime scenes and different resources, such as DNA samples, fingerprints, video photos, and more.

Computers additionally accumulate information from investigations into past crimes. For example, DNA databases that save the genetic records of convicted offenders may be regarded via computer applications to discover a shape for a brand new crime scene pattern.

SIGNIFICANCE OF COMPUTERS IN FORENSIC SCIENCE

Forensic pc era is a department of carried-out era that encompasses the strategies and strategies used to find out, acquire, maintain, and study bodily evidence in criminal investigations. Computers had been used notably in forensics as they are more particular, quicker, and extra accurate than people. They offer instantaneous access to information from all sources, facts from all resources may be stored digitally, and laptop photographs deal with manipulating photographs and movies to locate clues that might not be visible to the human eye.

The use and alertness of computers in this domain is growing at an exponential charge and presents solutions to many problems faced by forensic technicians. Forensic medicinal drugs are one of the oldest and most thrilling sciences inside the field of regulation. Forensic research is continually a key element inside the development of crime.

Forensic computer technological expertise is the software program of clinical strategies to reply to questions of hobby in a felony placing. It has been used in lots of instances to solve crimes, including excessive crime profile. Forensic technology is one of the fields which have been impacted by the advent of computers. Many laptop software programs now are used in forensic technological ability for analysis and identity.

Computer technology is having a prime impact on the forensic technology subject. It is utilized in crime investigations and crook law. Without using computers, crime justice would not have improved as much as it has. Within the final twenty years, the pc era has had an extensive effect on the manner that crime justice operates, from research tactics to crook law, and even to how we conceptualize justice. One example of this would be how pc algorithms are utilized by police departments to perceive capacity suspects from a pool of possible suits in instances in which fingerprinting isn't always possible for some purpose.

Computer forensic technological ability is a department of pc technological ability that deals with the retrieval and analysis of statistics from computer

systems and digital storage gadgets. It is one of the newest technological fields in forensic technological know-how. This place has seen an incredible boom in the last few decades, as more digital statistics accumulate on computers, garage devices, networks, and so on. Criminals also use superior technology to commit crimes like cyber robbery or identity theft. The demand for laptop forensics specialists in law enforcement agencies has multiplied tremendously.

CONCLUSION

The conclusion of analytical science in crime investigation has been made possible only because of the development of newer equipment and methods. Forensic toxicology is one such branch that is used to identify drugs in blood or tissue. In a forensic toxicology test, drugs are detected by testing for their metabolites, which are the substances that are produced when the drug breaks down into chemical compounds after it enters the body. These substances can be detected through urine, hair, or blood tests. The metabolites can also be detected in hair follicles as they contain cells that take up the drug and then store it inside them before they die and fall out.

In the Indian case, more consciousness changed into being placed and forensic science is a field of study that looks at how clinical techniques can be implemented to answer criminal questions. The technology of forensic science, like any other, is continuously evolving and changing. As it continues to conform and change, the era will improve and new strategies will continue to develop. There are limitless opportunities for what the destiny of forensic sciences can look like however one element is for certain, there'll constantly be people who want help solving crimes that might now not have been solved otherwise. In the past decade, forensic technological know-how has furnished important proof in lots of criminal investigations. From the crime scene to the court docket, forensic proof is used as a valuable device for prosecutors and defense legal professionals to help decide what honestly passed off. Forensic technological know-how is one of the clinical disciplines without a set of standards that may be applied universally. As such, it is based on an expansion of medical strategies for its applications and interpretations. Forensic toxicology has played a pivotal function in crime investigation as it facilitates to pick out what becomes consumed by means of the sufferer at some point earlier than death. The major regions of forensic science are biology, chemistry, and physics. Biology examines proof that includes animals or plants; chemistry studies evidence like blood, paint samples, or gunshot residue; and physics looks at items like damaged glass or tire tracks. Near the end of this section, I will be discussing how forensic science is used in solving crimes. Forensic science is a way for scientists to gather evidence about a crime scene for use in court. What they do not know is what the law enforcement agency has gathered because they only have access to the pictures and video taken by their cameras and detectives. They often use methods such

as mitochondrial DNA analysis or isotopic analysis to catch criminals who are hiding behind DNA masks or food particles that have been left at crime scene.

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