

Crime Scene Investigation and Role of Artificial Intelligence

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Abstract:

Crime scene investigation constitutes a foundational and critical stage within the criminal justice system, involving the systematic examination and collection of physical evidence left at the scene of an offence. This process relies heavily on forensic expertise to identify, preserve, and interpret even the most minute traces inadvertently left by perpetrators. As the custodian of justice and protector of victims' rights, the State bears a stringent obligation to ensure the integrity, accuracy, and accountability of evidence collection and verification conducted by investigating authorities. However, persistent systemic deficiencies, including procedural lapses and potential biases, have raised concerns regarding the effective protection of victims and the reliability of investigative outcomes. In this context, the emergence of Artificial Intelligence (AI) in crime scene reconstruction and evidence analysis has generated optimism, particularly due to its perceived objectivity, efficiency, and resistance to socio-economic biases. Despite its transformative potential, the integration of AI also exposes underlying structural failures within the existing system, highlighting that technological intervention alone cannot rectify deep-rooted institutional shortcomings. This paper critically examines the role of AI in crime scene investigation, evaluating whether it can genuinely enhance fairness and accuracy, or whether its effectiveness remains constrained by the limitations of the broader criminal justice framework.

Keywords: Crime Scene, Artificial Intelligence, Evidence, Examination, Procedure

Introduction: Understanding of Crime and Crime Scene

A simple act of physical action, is considered as a conduct, whereas crime is as an act or omission that violates the law of state and is punishable by the legal system. It is considered a wrongful act against the society, not mere against the individual. The act of crime can be perused in different perspective i.e,

1. Socially, the crime is an unapproved and unacceptable behavioral conduct of the individual against the norms of the societal orders.
2. Morally, crime can be seen as an act of demonizing¹ the Human and Ethical Values.
3. Psychologically speaking, the act of crime is a mental condition impacted form personality, emotions and habitual behavioral pattern of the offender
4. In the perspective of Criminal Jurisprudence, it is a social phenomenon involving the causes of crime, victimization, criminal procedures, preventive measures, and sanctions.
5. Legally speaking, crime is an act prohibited by law and punishable only by the State on proved guilty.

¹ Refers to the intentional portrayal of foundational principles such as empathy, honesty, and justice as if they are weak, foolish, or even dangerous.

Definition of Crime²:

1. According to Bentham: “Offences are whatever the legislature has prohibited for good or bad reason.”
2. Stephen refers: - “Crime is an act forbidden by law and which is at the same time revolting to the moral sentiments of the society.”
3. Austin emphasizes:- “A wrong which is pursued at the discretion of the injured party and his representatives is a civil injury; a wrong which is pursued by the Sovereign, or his subordinates is a crime.”

Definition of Crime Scene

A crime scene is any place where a crime has taken place. It is the primary location where investigators begin the process of uncovering the truth behind a criminal act. Crime Scene Investigating Officers (CSIOs), police personnel, and forensic experts carefully examine the area to collect different forms of evidence such as blood stains, fingerprints, hair samples, bodily fluids, skin particles, weapons, and other materials connected to the offence. A crime scene can include a person’s body, a house or building, vehicles, open spaces, or any object that may contain useful evidence for the investigation. Crime scene examination refers to the scientific process of identifying, preserving, collecting, and analysing physical evidence from these locations.³

Importance of Crime Scene Investigation in the Criminal Justice System

Crime Scene Investigation (CSI) plays an essential role in the criminal justice system because it forms the basis of a criminal investigation. By scientifically examining the place where the crime occurred, investigators can reconstruct the sequence of events and identify the persons involved. Proper collection and preservation of evidence help in establishing facts before the court and reduce the chances of wrongful conviction. CSI also protects the rights of victims and accused persons by ensuring that investigations are based on reliable and scientific evidence rather than mere suspicion. Therefore, an effective crime scene investigation is crucial for delivering justice and maintaining public confidence in the legal system.⁴

Scope of Crime Scene Investigation:

1. **Collection and Preservation of Evidence:** It primarily it helps in the identification, collection, preservation, and analysis of physical and biological evidence, collection of materials evidences such as fingerprints, blood stains, weapons, hair, fibers, footprints, and digital devices provide crucial information regarding the commission of the offence.
2. **Identification:** It assists investigating agencies in tracing the accused through scientific methods such as: Fingerprint analysis, DNA, Ballistic examination, Digital Forensic analysis
3. **Reconstruction of the Crime:** The reconstruction of the crime scene investigation helps investigators to sequence events that occurred before, during, and after the crime for a factual understanding of the offence committed. The experts can determine the time, nature of offences, pattern of crime, position of both victim and accused, motive, relationship etc.,

² General Introduction to Crime, Lawsaarathi.com, visited on 11th May, 2026, available at <https://www.lawsaarthii.com/blogs/general-introduction-of-crime/>

³ Crime Scene Investigation, United Nations Office on Drugs and Crimes, visited on 11.05.2026, available at https://www.unodc.org/documents/human-trafficking/Toolkit-files/08-58296_tool_5-9.pdf

⁴ Crime Scene Investigation, visited on 11.05.2026, available at <https://www.ebsco.com/research-starters/applied-sciences/crime-scene-investigation>

4. **Ensuring Scientific and Fair Investigation:** being technologically driven the use of the scientific method ensures the investigation to be accurate and impartial in the best interest to protect the individual rights as well as the societal interest.
5. **Strengthening Judicial Decision-Making:** the criminal justice system heavily relies on proper documentation supporting the investigation of crime scene for ensuring fair trial.
6. **Importance in Modern and Cyber Crimes:** this era is witnessing an increase in the crime rate to mitigate them our criminal system shall be technology advanced in making the use of electronic and digital evidence such as CCTV footage, Mobile analysis like WhatsApp, payment history, call history, usage of apps, Online Shopping etc.,

Stages of the Crime Scene investigation⁵:

1. **Initial Stage or Arriving at the scene:** On receipt of the information, the IRO⁶ shall arrive at the scene with safety producers to access the scene promptly and cautiously enter the scene and be observant of the remains of the crime scene.
2. **Safe procedure:** The initial responding officers shall check for any dangerous elements, situation or persons in the crime scene and should proceed to take control of them, to protect the place of crime scene. Additionally, the IRO shall identify, control and remove the persons exposing danger to the investigation.
3. **Emergency care:** the initial task of the IRO is to separate the persons who are witnesses, bystanders and suspects so as to enable to keep intact the scene of crime and further lead the medical team to remove the victim for the place and provide immediate medical care and assistance without damaging or contaminating the scene of crime.
4. **Initial Assessment⁷:** at this stage the IRO shall conduct initial assessment with respect to identifying boundaries, extent of boundaries, take control of the crime area by separating them from common place, tape around the parameters i.e., like covering the area with YELLOW tape or closing the doors and lobbies in case of hotel rooms etc.,
5. **Documentation:** the IRO makes a detailed documentation from the initial arrival till the briefing of the case to the Investigators. The purpose of the documentation is to permanently record the condition of the crime scene and its physical evidence.⁸ This documentation recorded keeps the minute details identified, assessed and taken to control in the crime scene. This helps in building up the case for the prosecution to fight against the accused.
6. **Management of Witnesses:** the IRO identifies and secures the witnesses, interviews them and records their responses, to assist the departmental regulations.

⁵ Four Major phrases at Crime Scene Investigation – Part 1, You tube, CSI Network, visited on 12.05.2026 Watched on 12.05.2026, available at https://youtu.be/1bWxF7s-2U8?si=_LnAdM7y22jXI2x8

⁶ IRO, is the initial responding officer are also known as first responder, responsible to provide emergency care, secure the scene and evidences, identify witnesses. Watched on 12.05.2026, available at https://youtu.be/1bWxF7s-2U8?si=_LnAdM7y22jXI2x8

⁷ Standard Operating for Crime Scene Investigation, Director of Forensic Science Services, visited on 12.05.2026, available at www.dfs.nic.in/

⁸ Crime Scene Investigations, by A.K.Kapoor and Indelah Khan, visited on 13.05.2026, available at <https://ebooks.inflibnet.ac.in/antp07/chapter/crime-scene-investigations/>

Every contact leaves a Trace⁹

The Key principle employed in the crime scene investigation is “**Locard’s Exchange Principle**”, the principle famously quoted, that, “whenever someone enters or exists the environment something is physically added and something is removed from the scene.”

The idea of employing this principle is to establish a relationship between the victim and culprit, it is further used as a link to suspect the persons, objects and physical evidence available in the crime scene. The links leads to associate all the evidences such as hair, fibers, blood stains, body fluids, fingerprints. Collections of these evidences mandates the ascertainment of questions such as “WHO DID THIS, WHEN WAS THIS DID AND HOW WAS THIS DONE”.

The Other Principles¹⁰ which are relied by the IRO’s, Investigators and Experts for decipher the crime scene:-

- **Principle of Probability:** it refers to a manner or mode of commission of a crime out of number of ways available, in a simple term it says the possible way of commission of crime.
- **Principle of Comparison:** under this principle the collected evidence is put forth in different examinations for correct evaluation of the collected sample such as hair, semen, bloodstains, skin etc.,
- **Principle of Linkage:** it refers to associated evidence and controlled evidence which are capable of linking the situation in the crime scene.
- **Principle of Analysis:** here the IRO after collecting the samples send the same for examination in the lab and later the same is approved by the forensic experts and on advice of the experts the collected and tested samples shall be preserved for the future references.
- **Principle of Individuality:** This principle emphasizes that no two objects have duplicate characteristics. It speaks about the non-similarities in the crime scene, though the crime or offence apparently looks like similar, the deep investigation shows that every crime scene has its own distinct and unique features.

Role of Forensic Science in Crime Scene Investigation

The term forensic is derived from a Latin term called “forensis” means use of scientific methodology in legal matter. Forensic Science is a systematic application of scientific principles and technique to analyses the collected samples from the crime scene and also to aid the investigation to speed up the justice delivery as bridge between science and justice. The term 'forensic,' symbolizing a link to the legal sphere, accentuates that forensic science administers scientific tenets to matters of law. The role of forensic science is extensive, incorporating assorted territories such as DNA assessment, fingerprint analysis, autopsies, pathology, and toxicology. These areas jointly provide to untangling the cause of death and initiating potential interconnections to the accused.¹¹

⁹ A simplified guide to Crime Scene Investigation, NFSTC and BJA, U.S. Department of Justice, visited on 12.05.2026, available at <https://stidhamreconstruction.com/wp-content/uploads/2014/03/>

¹⁰ Principles of Forensic Science, by SIFS, India, visited on 13.05.2026, available at <https://www.sifs.in/blog-details/principles-of-forensic-science>

¹¹ Role of Forensic Science in Crime Scene Investigation, Llyord Institute of Forensic Science, visited on 13.05.2026, available at <https://lifs.co.in/blog/role-of-forensic-in-crime-investigation.html>

Impact of Forensic Science on Crime Scene Investigation¹²

Forensic science significantly enhances the investigative process by providing scientific and objective methods for examining evidence collected from crime scenes. Its contribution to the criminal justice system can be understood through the following aspects:

- **Reconstruction of Events:** Forensic evidence assists investigators in reconstructing the sequence of events that occurred before, during, and after the commission of a crime. Techniques such as bloodstain pattern analysis help determine the nature of violence, movement of victims or offenders, and the type of weapon used. Such reconstruction enables investigators to develop a coherent narrative of the incident.
- **Identification of Suspects:** Scientific techniques including DNA profiling, fingerprint examination, ballistic analysis, and digital forensics play a crucial role in identifying suspects. These methods provide objective and reliable evidence that may corroborate or contradict witness statements, confessions, or alibis. DNA evidence, in particular, has become one of the most accurate tools for linking individuals to crime scenes and narrowing down potential perpetrators.
- **Exoneration of the Innocent:** Forensic science is equally important in protecting innocent individuals from wrongful conviction. Advanced forensic techniques, especially post-conviction DNA testing, have led to the exoneration of many wrongly convicted persons across the world. Initiatives such as the Innocence Project demonstrate¹³ helps to correct miscarriages of justice and reinforce public confidence in the legal system.
- **Judicial Scrutiny and Admissibility:** Admissibility of Forensic evidence is possible on the strict confirmation to the legal standards. Forensic experts are required to follow standardized procedures and maintain accuracy, reliability, and integrity in their analyses.

Role of Artificial Intelligence in Crime Scene Investigation

In the present era, crime no longer remains confined to traditional offences such as murder, kidnapping, theft, and robbery. Rapid advancements in modern technology have created numerous new avenues for the commission of both traditional and non-traditional crimes. The emergence of digital communication systems, the internet, mobile technologies, cloud computing, artificial intelligence, cryptocurrencies, and social media platforms has significantly transformed the nature, scope, and complexity of criminal activities. Earlier, investigations relied heavily on human expertise that was effective for a while, but often was time-consuming and prone to limitations.

Today, offenders exploit technological innovations not only to facilitate conventional crimes but also to commit sophisticated offences. Consequently, crime investigation has evolved beyond physical crime scenes and now extends into digital ecosystems where electronic evidence plays a crucial role in establishing criminal intent, conduct, and attribution. With the rise of digital data and complex crimes, old traditional methods are no longer sufficient to work on their own. This led to the integration of forensic technology, including databases, automated tools, and digital analysis systems.

¹² The Role of Forensics in Crime investigation: A Article review, International Journal of Research and Review, Volume II, issue 8, August 2024, visited on 13.05.2026, available at https://www.ijrrjournal.com/IJRR_Vol.11_Issue.8_August2024/IJRR52.pdf

¹³ DNA Exoneration in United States- Innocence project demonstrate, visited on 1305.2026, available at <https://www.nycourts.gov/reporters/webdoc>

Understanding AI:-

Artificial Intelligence refers to machines replicating the behaviours of human intelligence on a large scale. Operations like learning, reasoning, and decision-making are some of the intelligent behaviors AI possesses. AI systems can analyse large amounts of data, recognize patterns, and make predictions with minimal human intervention.¹⁴ Modern AI-enabled forensic systems assist investigators in identifying, documenting, preserving, and reconstructing physical crime scenes with greater precision. Some of the fields where AI is playing a vital role are as follows:

- Automated facial recognition and suspect identification.
- Bloodstain pattern analysis.
- Fingerprint and palm print comparison.
- Footwear and tire impression analysis.
- Ballistics and firearm examination.
- Crime scene photography enhancement.
- 3D crime scene reconstruction and spatial mapping.
- Video analytics and CCTV evidence interpretation.
- Detection of trace evidence such as fibers, hair, and biological residues.

Legal Framework for Admissibility of AI Evidence

Evidence is one of the most important parts of the criminal justice system because it helps investigators, lawyers, and judges find the truth. It provides the foundation for investigation, prosecution, and the final decision of the court. Without proper evidence, it becomes difficult to know whether a crime actually took place, who was responsible for it, and what punishment or legal remedy should be given. Evidence can include anything that helps in proving or disproving a fact, such as objects, documents, statements, digital records, or other information related to the case. In simple terms, evidence helps establish what really happened. It ensures that criminal cases are decided on the basis of facts and truth, rather than suspicion, emotions, or personal opinions.

The Hon'ble Supreme Court, has observed, with the increasing impact of technology in everyday life and as a result, the production of electronic evidence in cases has become relevant to establish the guilt of the accused or the liability of the defendant. And that the production of electronic evidence is of great help to investigation and the prosecution.¹⁵ The accused were acquitted from the charges on failure to collect electronic evidence i.e., CCTV footage from a crime scene i.e., hotel, the court considered this as **“withholding of best evidence”**.

In recent developments, Indian legislations have given wide recognition to digital and electronic evidence in response to the rapid growth of technology and cyber-related offences. Provisions under the Information Technology Act 2000, the former Indian Evidence Act 1872, and now the Bharatiya Sakshya Adhiniyam 2023¹⁶ have significantly expanded the admissibility and evidentiary value of electronic records in judicial proceedings. Electronic records such as emails, CCTV footage, digital documents, metadata, mobile communications, and online transactions are now recognized as important forms of evidence in both civil and criminal cases.

¹⁴ AI in Forensic Science: Role of AI in Crime Investigation, by Diya Das, published on 5th May, 2026, visited on 13.05.2026, available at <https://www.edept.co/blogs/ai-in-forensic-science-solving-crimes-with-technology>

¹⁵ Tomosu Bruno and another, v. State of U.P, 2015, Cri.L.J, 1690, <http://indiankanoon.org>, visited on 13.05.2026

¹⁶ Sec.2(d), 2(e), 61 and 63, deals with Electronic evidence and admissibility, Bharatiya Sakshya Adhiniyam, 2023

However, despite these advancements, Indian legislation remains largely silent regarding AI-generated evidence. There is no specific statutory framework that expressly defines, regulates, or prescribes standards for the admissibility and reliability of evidence generated through Artificial Intelligence systems, such as facial recognition technologies, predictive algorithms, automated forensic tools, or AI-assisted surveillance systems.

The Hon'ble Apex Court in *Anvar P.V. and Arjun Panditrao Khotkar* have established that compliance with Section 65B (4) certificates is mandatory to ensure authenticity, yet this framework remains a straitjacket for dynamic AI outputs. The primary hurdle is the “black-box problem”, where the internal logic of an algorithm is opaque even to its developers, often creating an “analytical gap” between raw data and the conclusion that may lead a court to exclude the evidence. Consequently, AI generated proof in India is currently viewed as being in a rudimentary stage, requiring either a judge or a separate human expert to re-verify the methodology and facts before it can be legally relied upon.¹⁷

Conclusion:

In conclusion, crime scene investigation plays a crucial role in the criminal justice system by helping uncover the truth behind a crime through the collection, preservation, and analysis of evidence. With the rapid growth of technology, Artificial Intelligence has emerged as an important tool in modern investigations. AI can assist investigators in analysing large volumes of data, identifying patterns, enhancing digital and forensic examinations, and improving the speed and accuracy of investigations. Its use has the potential to reduce human error and make the investigative process more efficient.

However, despite these advantages, the use of AI in criminal investigations also raises important legal and ethical concerns. The reliability, transparency, and authenticity of AI-generated evidence must be carefully examined before it is accepted in court. In India, while legislation such as the *Bharatiya Sakshya Adhiniyam, 2023*, has recognised electronic and digital evidence, there is still limited direct recognition of AI-generated evidence. Therefore, the judiciary plays an important role in determining its admissibility by ensuring that such evidence satisfies the legal requirements of authenticity, relevance, and reliability. Thus, while AI has the capacity to transform crime scene investigation and strengthen the administration of justice, its effectiveness ultimately depends on proper legal safeguards, responsible use, and judicial scrutiny to ensure fairness and protection of individual rights.

¹⁷ AI in Digital Forensics: Are Indian Evidence Laws Equipped to Handle Machine-Generated Proof? Vagisha Mandloi 26 Apr 2026, visited on 13.05.2026, available at <https://www.livelaw.in/articles/digital-forensics-indian-evidence-laws-ai-generated-proof-531826>