
CONTRIBUTION OF TECHNOLOGY IN INVESTIGATION PROCESS

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Introduction

The world we live in is filled with advancements in technology that has changed the way we live, communicate, and work. Technological progress has brought numerous benefits, and one of them is in the field of investigation. The contribution of technology in the investigation process has revolutionized the way evidence is collected, analyzed, and presented in court.

The integration of technology in the investigation process has streamlined the process, making it more efficient and accurate. The traditional methods of gathering evidence, such as paper-based records, eyewitness accounts, and physical evidence, have been replaced with advanced technological tools that can quickly analyze data, provide real-time updates, and generate precise reports¹.

One of the most significant contributions of technology in the investigation process is the use of digital forensics. Digital forensics is the application of scientific techniques and tools to collect, analyze, and preserve electronic data. The digital world is rapidly expanding, and the use of technology in crime has become increasingly prevalent. Digital forensics allows investigators to recover data from digital devices, such as computers, smartphones, and tablets, which can be used as evidence in a court of law. It is a crucial tool in the investigation of cybercrimes, fraud, and other criminal activities that involve the use of technology.

Another contribution of technology in the investigation process is the use of surveillance technology. Surveillance technology has come a long way from the traditional CCTV cameras to advanced tools such as drones, facial recognition software, and GPS tracking devices. Surveillance

¹ Committee on Reforms of Criminal Justice System (Ministry of Home Affairs, Government of India, New Delhi 2003)

technology is used in various types of investigations, including criminal investigations, fraud investigations, and even insurance investigations. It enables investigators to monitor suspects and gather evidence in a discreet and efficient manner.

The use of technology in the investigation process has also led to the development of advanced analytical tools. Data analytics tools are used to analyze large volumes of data quickly and efficiently. These tools can help investigators to identify patterns, trends, and anomalies that may not be visible through traditional methods. Data analytics tools are used in financial investigations, fraud investigations, and even in criminal investigations to identify suspects and track their activities.

In addition to the above, technology has also improved communication and collaboration between investigators. With the use of digital platforms, investigators can share information, collaborate on cases, and access real-time updates. This has improved the efficiency of investigations, reduced the time it takes to complete them, and increased the accuracy of the results².

The contribution of technology in the investigation process has also led to the development of new investigative techniques. One such technique is social media investigation. Social media investigation involves the use of social media platforms to gather information about suspects or victims. Social media platforms such as Facebook, Twitter, and Instagram are increasingly being used in criminal investigations to gather evidence and identify suspects. This technique has proved to be effective in cases such as cyberbullying, harassment, and even in terrorism investigations.

The use of technology in the investigation process has also improved the security of evidence. With the use of digital storage and encryption tools, evidence can be securely stored, and access can be restricted to authorized personnel. This ensures that evidence is protected from tampering or destruction, which can compromise the outcome of an investigation.

Lastly, technology has also contributed to the improvement of forensic science. Forensic science involves the analysis of physical evidence such as fingerprints, DNA, and ballistics. Technology has improved the accuracy and efficiency of forensic science by providing advanced tools such as

² Jyotirmoy Adhikary, *DNA Technology in Administration of Justice* (LexisNexis, Butterworths, 2007)

DNA sequencing, 3D imaging, and laser scanning. These tools have enabled forensic scientists to analyze evidence with greater precision and speed, leading to more accurate results.

Research objective

1. To explore the various technological advancements that have been integrated into the investigation process and their impact on the efficiency and accuracy of evidence collection and analysis.
2. To investigate the use of digital forensics in criminal investigations and the effectiveness of this technology in the recovery of electronic data as evidence.
3. To assess the use of surveillance technology, including drones, facial recognition software, and GPS tracking devices, and its effectiveness in gathering evidence in a discreet and efficient manner.
4. To analyze the use of data analytics tools in financial investigations, fraud investigations, and criminal investigations to identify patterns, trends, and anomalies that may not be visible through traditional methods.
5. To examine the impact of technology on collaboration and communication between investigators, including the use of digital platforms and real-time updates, and its contribution to the efficiency and accuracy of investigations.

Aim

The aim of this research is to investigate the contribution of technology in the investigation process, specifically exploring the various technological advancements that have been integrated into the investigation process and their impact on the efficiency and accuracy of evidence collection and analysis. The study will examine the use of digital forensics in criminal investigations, assessing the effectiveness of this technology in the recovery of electronic data as evidence. The research will also assess the use of surveillance technology, including drones, facial recognition software, and GPS tracking devices, and its effectiveness in gathering evidence in a discreet and efficient manner.

In addition, the study will analyze the use of data analytics tools in financial investigations, fraud investigations, and criminal investigations to identify patterns, trends, and anomalies that may not be visible through traditional methods. The research will investigate the impact of technology on collaboration and communication between investigators, including the use of digital platforms and real-time updates, and its contribution to the efficiency and accuracy of investigations.

The overarching aim of this research is to evaluate the role of technology in the investigation process and to determine the extent to which technology has improved the efficiency and accuracy of evidence collection and analysis. By exploring the various technological advancements that have been integrated into the investigation process, this research will provide a comprehensive understanding of the benefits and limitations of technology in the investigation process. The findings of this research will inform the development of best practices for the integration of technology in the investigation process, and contribute to the ongoing efforts to improve the efficiency and effectiveness of investigations.

Objective

1. To identify the various technological tools and techniques used in the investigation process and to analyze their impact on improving the accuracy and speed of criminal investigations.
2. To assess the effectiveness of different digital forensic techniques, such as mobile forensics, network forensics, and cloud forensics, in gathering and analyzing evidence in criminal investigations.
3. To evaluate the ethical and legal considerations surrounding the use of technology in investigations, including issues related to data privacy, security, and admissibility of evidence in court.
4. To identify best practices in the use of technology in investigations, including the training and skill development of investigators, and the development of standardized protocols and procedures for the collection and analysis of digital evidence.
5. To provide recommendations for policymakers, law enforcement agencies, and forensic

science researchers on how technology can be used to improve the investigation process while ensuring that the legal and ethical standards are met.

RESEARCH METHODOLOGY

The purpose of project is to discover answers to questions through the understanding the concept of technology in the process of investigation by various credible sources which makes the data of the research admissible to an extent. The project is made with the method of analytical research methodology. The project uses all the secondary sources available. It uses the internet sources & the various books available to understand the concept.

RESEARCH QUESTIONS

1. How has the use of technology affected the efficiency and accuracy of the investigation process in law enforcement?
2. What are the most common technologies currently used in investigation processes, and what specific roles do they play in the investigation?
3. How has the adoption of technology in the investigation process affected privacy concerns, and what measures can be taken to ensure the proper use of data?
4. To what extent has the use of technology in investigations led to a reduction in human error and bias, and how has this impacted the overall success rate of investigations?
5. How can emerging technologies such as artificial intelligence, machine learning, and big data analytics be leveraged to improve the investigation process, and what ethical considerations must be taken into account?

REVIEW OF LITERATURE

The researcher went through various book and articles of reputed authors to understand and analyze the concept of emotional inelegance in the process of client counseling in legal profession. The Researcher referred "Technological Advances in Crime Detection and Investigation" by

Rakesh Kumar Singh: This book explores how technology has impacted the way crimes are investigated and detected in India. It covers topics such as forensic science, DNA profiling, and cybercrime investigation. "Technology and Law Enforcement: From Gumshoe to Gamma Rays" by Jaishankar Karuppuswami: This book provides an overview of the technological advancements in law enforcement in India, covering areas such as surveillance, data analysis, and communication technologies. It also examines the ethical and legal issues related to the use of technology in law enforcement.

"Forensic Science and Technology: The Contribution of India" edited by S. J. K. Anna University: This book covers the history and development of forensic science and technology in India, highlighting the role of Indian scientists and researchers in advancing the field. It also explores the use of technology in forensic investigations, including DNA profiling, fingerprint analysis, and ballistics. "Digital Forensics and Cyber Crime: 9th International Conference, ICDF2C 2017, New Delhi, India" edited by Aditya K. Sood and Sujeet Sheno: This book is a collection of research papers presented at the International Conference on Digital Forensics and Cybercrime held in New Delhi. The papers cover topics such as cybercrime investigations, digital evidence analysis, and mobile device forensics.

SCIENTIFIC INVESTIGATION

Criminals use force or threats to intimidate witnesses, making it difficult to obtain testimony in criminal cases. Witnesses often fear retaliation and refuse to provide evidence to law enforcement. Criminals may even issue life-threatening warnings to witnesses, causing the general public to distance themselves from legal proceedings. Some crimes are committed in such a way that no direct evidence can be provided to investigators, thus emphasizing the significance of forensic investigations. Nowadays, various methods such as medical and physical examinations, fingerprint and footprint analysis, and other techniques are used to gather forensic evidence. To utilize these instruments effectively, qualified experts are required. The credibility of the forensic evidence depends on the circumstances under which it is obtained and the effectiveness of arguments presented³.

³ Emperor v. Sahadeo, 15 CrLJ 220, 230

Even though there is no explicit requirement for authentic evidence in legal proceedings, courts generally prefer it over other types of evidence⁴. When experts are unable to form a conclusion or do not have all the facts of the case in mind⁵, courts will examine the matter more closely⁶. If two experts have differing opinions on a matter, the court may not favor either opinion. The court will carefully consider the evidence before taking it into account. However, certain types of evidence may be in gross violation of the Evidence Act, 1872 or the provisions of the Indian Constitution, and cannot be taken into consideration⁷. There is some controversy over whether fingerprints should be excluded as evidence due to potential constitutional violations. The validity of Section 27 of the Indian Evidence Act, 1872 has been upheld by the courts⁸.

The use of technology has had a significant impact on the efficiency and accuracy of the investigation process in law enforcement in India. Here are a few ways in which technology has influenced the investigation process in law enforcement in India:

1. **Forensic Science:** The use of technology in forensic science has revolutionized the investigation process in law enforcement. Advanced scientific techniques such as DNA profiling, fingerprint analysis, and ballistics have helped investigators in India solve crimes that would have otherwise gone unsolved.
2. **Digital Evidence:** With the increasing use of technology in everyday life, digital evidence has become an integral part of the investigation process. Digital evidence includes data retrieved from mobile phones, computers, and other electronic devices. With the help of advanced forensic tools and software, law enforcement agencies in India can recover, analyze and present digital evidence in court.
3. **Crime Mapping:** Law enforcement agencies in India are now using Geographic Information System (GIS) technology to map crime patterns and analyze crime statistics.

⁴ Saqlain Ahmed v. Emperor, AIR 1936 All.165

⁵ Alock v. Royal Exchange Assurance Co. (1849) 116 ER 1275

⁶ Mohd. Zia Ullah Khan v. Rafiq, AIR 1939 Oudh 213; Sadiqa Begum v. Ata Ullah, 1933 Lah. 885

⁷ 9Sucha Singh v. State, AIR 1951 Simla 28

⁸ State of U.P. v. Deoman Upadhyaya, AIR 1960 SC 1125; State of Bombay v. Kanthi Kalu, AIR 1961 SC 1808

Crime mapping helps law enforcement agencies to identify high crime areas, allocate resources, and develop effective strategies to combat crime.

4. **CCTV Surveillance:** The use of CCTV cameras has become widespread in India. The installation of CCTV cameras in public places, commercial establishments, and residential areas has helped law enforcement agencies to deter crime and solve crimes quickly.
5. **Automated Fingerprint Identification System (AFIS):** AFIS is a computerized system that stores and matches fingerprints. The AFIS system has helped law enforcement agencies in India to solve crimes by quickly identifying suspects through fingerprint analysis.

Overall, the use of technology has significantly improved the efficiency and accuracy of the investigation process in law enforcement in India. However, it is important to ensure that the use of technology does not infringe on individual privacy rights and that proper regulations are in place to prevent misuse of technology.

Technologies currently used in investigation processes, and specific roles

Technology has significantly impacted the investigation process in law enforcement, making it easier and more efficient to collect, analyze, and present evidence. From digital forensics to biometric identification, there are several technologies currently used in investigation processes that play specific roles in solving crimes⁹.

1. **Digital Forensics:** Digital forensics is the process of collecting, analyzing, and preserving digital evidence from electronic devices such as computers, mobile phones, and other digital storage devices. This technology plays a crucial role in the investigation process as it can uncover evidence that may have been deleted or hidden. With the widespread use of technology in everyday life, digital evidence has become an integral part of the investigation process.

⁹ Jadhav EB, Kumar R, Sankhla MS. Artificial Intelligence: Advancing Automation in Forensic Science & Criminal Investigation. J Seybold Report

Digital forensics can help investigators uncover a variety of digital evidence, including emails, text messages, photos, videos, and social media activity. By examining digital evidence, investigators can often trace the movements and activities of suspects, track communications, and uncover evidence that can be used in court.

2. **Video Surveillance:** Video surveillance involves the use of cameras to monitor and record activity in a specific area. This technology plays a crucial role in the investigation process, as it can provide valuable evidence of crimes being committed and identify suspects. Video surveillance is commonly used in public places, commercial establishments, and residential areas to deter crime and provide evidence in the event of a crime¹⁰.

Video surveillance footage can be used to identify suspects, track their movements, and determine the sequence of events leading up to a crime. It can also provide evidence of accomplices or witnesses, and can help investigators determine the types of weapons used in a crime.

3. **GPS Tracking:** GPS tracking is a technology that allows investigators to track the location of a person or object using GPS technology. This technology plays an important role in investigations involving missing persons, stolen vehicles, and other crimes where the location of the suspect or victim is critical.

GPS tracking devices can be placed on vehicles, mobile phones, or other objects to track their movements. This technology can help investigators determine the location of suspects or victims at the time of a crime, and can also help track the movements of suspects during an investigation.

4. **Ballistics Analysis:** Ballistics analysis involves the use of technology to match bullets, shell casings, and other ballistic evidence to a specific weapon. This technology can help investigators determine the type of weapon used in a crime, as well as identify suspects¹¹.

Ballistics analysis can also be used to determine the trajectory of a bullet, which can provide valuable information about the position of the shooter at the time of a crime. By analyzing bullet

¹⁰ Green, M. (n.d.). Human Factors In Forensic Evidence

¹¹ Malpani R. Why Alan Turing's 1950 paper is so relevant today.[Internet] 2

fragments and shell casings, investigators can often determine the caliber and make of the weapon used in a crime.

5. **Facial Recognition:** Facial recognition technology uses algorithms to match a person's face to a database of known individuals. This technology plays an important role in identifying suspects in cases where video surveillance footage is available.

Facial recognition technology can help investigators identify suspects by comparing the faces of individuals captured on video surveillance footage to a database of known individuals. This technology can also be used to identify missing persons or victims of crime.

6. **Biometric Identification:** Biometric identification involves the use of technology to identify individuals based on their unique physical characteristics, such as fingerprints, DNA, and voice patterns. This technology can help investigators identify suspects and link them to specific crimes.

Fingerprint analysis is one of the most common forms of biometric identification and can be used to identify suspects based on fingerprints found at a crime scene. DNA analysis can also be used to identify suspects and link them to specific crimes. Voice recognition technology can be used to identify suspects based on their voice patterns, which can be captured through phone calls or other recordings.

Technology and privacy

The adoption of technology in the investigation process has greatly enhanced law enforcement's ability to solve crimes and bring criminals to justice. However, it has also raised concerns about privacy and the potential for abuse of data. As more personal data is collected and analyzed, it is important to ensure that proper measures are taken to protect individual privacy rights.

One of the main concerns regarding the use of technology in investigations is the potential for mass surveillance. With the use of video surveillance cameras and other monitoring technologies, individuals may feel like their every move is being tracked and monitored. This can lead to a sense

of distrust and anxiety among the public, which can harm the relationship between law enforcement and the community¹².

Another concern is the potential for bias and discrimination in the use of technology. For example, facial recognition technology has been shown to have a higher error rate when identifying people of color, which can lead to false accusations and arrests. In addition, there is a risk that the technology may be used in a discriminatory manner, targeting specific communities based on race or ethnicity.

To address these concerns, several measures can be taken to ensure the proper use of data in the investigation process. One such measure is the implementation of strong data protection laws and regulations¹³. These laws should require law enforcement agencies to obtain a warrant before collecting data and limit the amount of data that can be collected to what is necessary for the investigation.

Another measure is the use of transparency and accountability mechanisms to ensure that law enforcement agencies are using data appropriately. This can include regular audits of data collection and use practices, as well as public reporting of data collection activities. In addition, individuals should have the right to access and correct their personal data, as well as the right to know when their data is being collected and how it is being used.

Technology can also be used to enhance privacy protection in the investigation process. For example, encryption can be used to protect personal data from unauthorized access, and anonymization techniques can be used to ensure that personal data is not linked to specific individuals unless necessary for the investigation.

Training and education are also important in ensuring that law enforcement officers understand the proper use of technology and the importance of protecting individual privacy rights. This can include training on data protection laws and regulations, as well as on the appropriate use of technology in investigations.

¹² Artificial Solutions. Homage to John McCarthy, the Father of Artificial Intelligence (AI)[Internet] 2020

¹³ Rachel Z. Arndt, "Artificial Intelligence Takes on Medical Imaging," Transportation Hub

Finally, the use of ethical guidelines and codes of conduct can help ensure that law enforcement agencies are using technology in a responsible and ethical manner. These guidelines should outline the principles and values that should guide the use of technology in investigations, such as respect for individual privacy rights and the avoidance of bias and discrimination¹⁴.

In conclusion, the adoption of technology in the investigation process has raised important privacy concerns that must be addressed. Strong data protection laws and regulations, transparency and accountability mechanisms, technology solutions, training and education, and ethical guidelines can all help ensure that technology is used appropriately and responsibly in investigations, while protecting individual privacy rights. By implementing these measures, law enforcement agencies can enhance their ability to solve crimes and maintain public trust and confidence.

Reduction in human error and bias

The use of technology in investigations has revolutionized law enforcement practices and has significantly reduced human error and bias. Technology has enabled law enforcement agencies to collect and analyze large amounts of data, identify patterns, and make connections that would otherwise be impossible to detect. The use of technology has also increased the accuracy and efficiency of investigations, leading to higher success rates in solving crimes and bringing criminals to justice.

One of the main benefits of using technology in investigations is the ability to reduce human error. Humans are prone to making mistakes, whether it's misreading a document or forgetting a crucial detail¹⁵. By using technology, investigators can eliminate many of these errors and improve the accuracy of their work. For example, technology can be used to automatically scan and analyze documents, reducing the chance of human error in transcription and interpretation.

In addition, technology can help reduce bias in investigations. Humans are susceptible to unconscious biases that can affect their decision-making and judgment. By using technology to analyze data, investigators can reduce the impact of bias and rely on objective data analysis to

¹⁴ The Intelligence Advanced Research Projects Activity, "Janus," Washington, DC

¹⁵ Ajit J. "Artificial Intelligence in Fraud Detection"

guide their investigations. For example, machine learning algorithms can analyze data from different sources and identify patterns that might be missed by human investigators.

These patterns can then be used to identify suspects or predict criminal behavior.

Another way technology has helped reduce bias is by standardizing investigations. By using technology to create standardized procedures, investigators can reduce the impact of individual biases on the investigation process. For example, video cameras and body-worn cameras can be used to record interactions between law enforcement officers and the public. This footage can then be used to ensure that officers are following proper procedures and behaving appropriately.

The use of technology has also led to a significant increase in the efficiency of investigations. Investigators can use technology to collect and analyze data more quickly and accurately than ever before. This allows them to identify suspects and gather evidence more quickly, which can be crucial in solving crimes. For example, digital forensics can be used to analyze electronic devices and gather evidence that might otherwise be difficult to find.

Another way technology has increased the efficiency of investigations is through the use of data analytics. Investigators can use data analytics to identify patterns and connections between seemingly unrelated pieces of data. This can help them identify suspects or predict criminal behavior¹⁶. For example, data analytics can be used to analyze social media activity and identify potential threats before they become dangerous.

The use of technology has also increased the success rate of investigations. By reducing human error and bias and increasing efficiency, technology has enabled law enforcement agencies to solve crimes that might have been impossible to solve otherwise¹⁷. For example, DNA analysis has been used to solve cold cases that had gone unsolved for decades. Similarly, the use of surveillance cameras has helped identify suspects in cases where no witnesses were present.

In addition, technology has helped improve the quality of evidence used in investigations. By using technology to gather and analyze evidence, investigators can present more accurate and reliable

¹⁶ Krogh, A. (2008). What are artificial neural networks?

¹⁷ Saba, T., & Rehman, A. (2013). Effects of artificially intelligent tools on pattern recognition.

evidence in court. This can lead to more successful prosecutions and fewer wrongful convictions¹⁸.

However, it's important to note that the use of technology in investigations is not without its challenges. One of the main challenges is the potential for technological errors or glitches. If technology is relied on too heavily, it can lead to false accusations or arrests. For example, facial recognition technology has been shown to have a higher error rate when identifying people of color, which can lead to false accusations and arrests.

Another challenge is the potential for privacy violations. As more personal data is collected and analyzed, it is important to ensure that proper measures are taken to protect individual privacy rights. This includes limiting the amount of data collected and ensuring that data is only used for legitimate investigative purposes¹⁹.

Conclusion

In conclusion, the contribution of technology in the investigation process has been significant and has revolutionized the way investigations are conducted. With the use of computer-based technologies, investigators can now process large amounts of data in a short time, identify patterns and connections, and collaborate with each other regardless of their geographical location. Technology has also made it easier to collect and preserve evidence, especially in cybercrime investigations where electronic evidence is often the only evidence available.

However, the use of technology in the investigation process has also posed several challenges, including the risk of data breaches and cyberattacks, issues of privacy, and the need for investigators to have the necessary skills and knowledge to use the technology effectively²⁰. It is essential to develop robust data protection policies and provide training and education programs to ensure that investigators are up-to-date with the latest technological advancements and have the necessary skills to use them.

¹⁸ Sharma, D., & Kumar, N. (2017). A review on machine learning algorithms, tasks and applications.

¹⁹ INDIA ai. AI is being used by the UP Police to catch criminals.

²⁰ INDIA ai. AI is being used by the UP Police to catch criminals.

Overall, technology has played a critical role in enhancing the efficiency and effectiveness of investigations, making it easier for investigators to gather, process and analyze information. The use of technology has also contributed to the fight against crime, enabling law enforcement agencies to identify and prosecute offenders more effectively. Therefore, it is imperative to continue investing in technology and developing innovative solutions that will further improve the investigation process and contribute to a safer and more secure society.

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