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An Eye of Justice: A Case Study on Crime Case Analysis Using CCTV Footage

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ABSTRACT

Crime continues to be a major concern in modern society. Urbanization and population growth make it worse, showing the need for effective strategies like using Closed-Circuit Television (CCTV) for preventing and solving crimes. This study was based on the Routine Activities Theory and Situational Crime Prevention Theory. A qualitative case study design was employed through in-depth interviews with police officers and establishment owners in Ozamiz City. The data were analyzed using Yin's five-phase method, which includes compiling, disassembling, reassembling, interpreting, and concluding. The findings showed that CCTV is important for recording traffic-related incidents and crimes against persons and property. It also supports reactive backtracking and suspect identification. Additionally, CCTV is a useful tool for proactive real-time monitoring and dispatch. However, the study noted challenges, such as technical limitations with CCTV systems and legal barriers to accessing footage. Despite these challenges, CCTV was highly effective in improving accountability, providing solid evidence, and informing strategic deployment of resources and technological and infrastructure enhancements. The study concluded that while CCTV is essential for modern crime analysis, its full benefits can only be achieved through regular upgrades, proper maintenance, better access procedures, and training for staff. Recommendations include improving technology infrastructure, simplifying legal processes, and encouraging cooperation between authorities and community members to create safer neighborhoods and better crime management.

Keywords: Backtracking; Closed-circuit Television; Crime; Data Privacy; Evidence; Intervention; Investigation; Suspect Identification; Prevention; Scheme; Surveillance; Technical Limitations.

1. Introduction

Crime continues to be a prevalent factor in modern society, impacting people and communities (Jonathan et al., 2021). With the growing complexities of criminal acts, there is a need for efficient crime prevention and solution strategies to maintain public security and safety (Juma, 2024; Paley, 2025). In this regard, studying the connection between crime and security is important in reducing crime and violence, formulating efficient law enforcement measures and community outreach programs (Bullock et al., 2022; Cheng & Chen, 2021). The contribution of technology to crime prevention has revolutionized the security and law enforcement landscape over the past few decades (Soto et al., 2021). Moreover, surveillance technologies such as closed-circuit television (CCTV) yield important visual evidence that can facilitate faster identification and arrest of suspects and reconstruction of crime scenes (Geldenhuys, 2023; Kirui, 2024; Maksymowicz et al., 2023). CCTV or closed-circuit TV, is an observation system for sending video feeds to a specialized group of monitors, offering live monitoring of the environment in locations like public places, offices, and residences (Kirui, 2023; Papale, 2024). According to a study, useful CCTV evidence increased case closure rates from 20% to 50% (Piza, 2024). However, as technology advances, it provides both new challenges and opportunities for law enforcement to adapt and innovate in pursuit of justice (Prayatno et al., 2024). Using CCTV footage has several difficulties that need to be addressed by authorities. Through the incorporation of insights gained from the analysis of crime, including that acquired through CCTV footage, intervention schemes may be specifically designed to solve certain problems and avoid future incidents (Lam et al., 2020). Although CCTV technology is extensively used in crime prevention, little is known about how crime case analysis using CCTV footage can directly inform the design of targeted intervention schemes for

authorities. Hence, this research will attempt to address this knowledge gap by examining how CCTV crime analysis can be applied to intervention programs to maximize law enforcement response and community safety.

1.1. Study Objectives

This study explored the analysis of crime cases using CCTV footage in Ozamiz City, Philippines, to better understand its role in crime prevention, investigation, and intervention. It sought to address the challenges, uses, and potential of CCTV in enhancing law enforcement strategies and public safety. Specifically, this study conducted the following:

1. Determined the types of criminal activities commonly captured in CCTV footage within Ozamiz City.

2. Identified the challenges and limitations encountered by authorities in utilizing CCTV footage for crime investigations.

3. Examined how the information obtained from CCTV footage influences or informs intervention strategies employed by law enforcement and community stakeholders.

4. Determined effective practices and strategies that enhance the utilization of CCTV data for crime prevention and resolution.

5. Developed recommendations for designing intervention schemes based on CCTV crime analysis to prevent recurrence and improve law enforcement responses.

2. Methods

This research utilized a case study research design to analyze crime incidents captured through CCTV footage as input in designing intervention schemes for the authorities. This study was conducted in Ozamiz City, Philippines, where the participants are residents who have experienced the impact of CCTV installations in their communities. The research used a purposive sampling method to select participants, specifically involving the police and owners of establishments equipped with CCTV cameras within Ozamiz City. Data collection proceeded until data saturation was achieved after ten (10) interviews/participants. The research employed the use of an interview guide as the main data collection tool. To allow for an extensive data collection process, in-depth, face-to-face interviews were carried out. Informed consent was obtained from all participants, ensuring they participated voluntarily and understood the purpose of the study. Participants were assured that confidentiality would be respected, with stern measures taken to ensure their privacy and anonymity were safeguarded during the research process. The analysis of the data followed Yin's (2014) five-phase method of qualitative data analysis, which included compiling, disassembling, reassembling, interpreting, and concluding. The rebuilt data yielded a thematic structure that captured the common experiences and practices of the participants regarding the use of CCTV recordings for crime investigation and intervention. In the concluding stage, the key conclusions derived from the analyzed data were presented. The findings were based on the data and provided the foundation for making recommendations on how to improve the application of CCTV as a means of facilitating public safety and enhancing law enforcement practices.

3. Results and Discussions

3.1. Traffic-Related Incidents

CCTV footage has been valuable in documenting traffic incidents like collisions and hit-and-run cases (Huang & Lee, 2024). It helps identify those responsible and provides clear evidence of what happened (Aballe et al., 2022). By capturing violations such as ignoring traffic signs or lane discipline, CCTV plays an important role in improving road safety and supporting police efforts in handling traffic incidents (Woods, 2021). Officers noted that the most common traffic incidents captured by CCTV include various types of vehicle accidents. These often involve collisions between vehicles and pedestrians, which are frequently linked to hit-and-run situations that cause physical injuries. They also mentioned that leaving the scene after an accident is considered a criminal offense. Moreover, minor traffic violations, especially at night when drivers often ignore traffic lights and signs, are regularly monitored and recorded by CCTV. These observations emphasize how crucial CCTV is in documenting and addressing traffic-related crimes in the area.

"The most common criminal activities that are commonly captured by CCTV in the Ozamiz area alone are vehicular accidents. Mostly, vehicle-to-vehicle, and sometimes vehicle against a pedestrian, hit and run, which might cause physical injuries to persons involved." (Police 3)

"Personally, I would say that the most common criminal activity captured in CCTV involves traffic accidents, where hit-and-run usually occurs. It may not be the person's intention to hit a pedestrian, but the act of leaving the scene after the accident is considered criminal to me." (Police 4)

"Based on my experience, in traffic, the most common criminal activity captured by CCTV's are minor traffic violations. Mostly at night, many would disregard traffic rules, not observing traffic lights, disregarding traffic signs, that's what we usually monitor." (Police 5)

The establishment owner supported the police officers' observations by stressing the real benefits of CCTV for solving traffic incidents. They pointed out that CCTV footage is key in determining who is responsible during collisions or minor accidents, like when someone claims to be "side swept" in a parking lot. By offering an unbiased record of events, CCTV is instrumental in revealing the truth and guaranteeing accountability. This shows its value as a trusted tool for both preventing and investigating traffic disputes. The owner's view highlights how CCTV technology assists law enforcement in effectively managing traffic-related crimes.

"CCTV is essential because, for example, if there's a collision on the road or a person complaining about getting 'side swept' in our parking area, it would help identify which of them is responsible. It's essential because it can tell you the truth, that that's what really occurred." (Establishment 1)

In conclusion, traffic-related incidents are some of the most common crimes captured on CCTV. They often involve vehicle collisions, hit-and-run cases, and minor traffic violations. These events usually include accidents between vehicles and sometimes involve pedestrians. A common problem is drivers leaving the scene after an accident. This behavior makes it harder to hold them responsible and worsens the situation. Also, nighttime traffic

violations, such as ignoring traffic lights and signs, frequently occur, leading to unsafe road conditions. CCTV footage plays a vital role in these cases. It provides clear evidence that helps identify those at fault, supports investigations, and helps prevent future incidents by encouraging better behavior. Recording and reviewing these incidents enhances public safety by promoting compliance with traffic laws and allowing for quick resolutions when violations occur.

Studies on traffic-related incidents captured by CCTV highlight the important role of surveillance technology in improving road safety and law enforcement. Research consistently shows that CCTV footage is important evidence in accident investigations, especially in hit-and-run cases where identifying the responsible party can be difficult (Saputra et al., 2024). Studies also indicate that continuous monitoring of traffic behavior through cameras helps cut down on violations like running red lights and speeding, which are common causes of road accidents (Cohn et al., 2020; Tilahun, 2023). Furthermore, research points out that the presence of CCTV serves as a deterrent, encouraging drivers to follow traffic regulations more closely (Aballe et al., 2022). However, some studies warn about limitations, such as blind spots in camera coverage and the need for high-quality video to ensure accurate identification (Brookman & Jones, 2022; Usha Rani & Raviraj, 2023). These studies support the inclusion of CCTV in traffic management systems as an effective way to improve accountability, reduce accidents, and promote safer road environments.

The findings on traffic-related incidents recorded by CCTV have important implications for public safety and law enforcement strategies. The ability of CCTV to provide clear evidence in accidents and traffic violations leads to more effective investigations and accountability. This could lower the number of unresolved cases like hit-and-runs. It highlights the need to expand and upgrade surveillance infrastructure, particularly in high-risk areas, to improve coverage and video quality. Additionally, the deterrent effect of visible CCTV cameras suggests that increasing their presence could encourage safer driving behaviors, ultimately lowering accident rates. These results also stress the importance of continuous monitoring and timely reviews of footage, as well as collaboration between community members and authorities to maximize the benefits of CCTV in traffic management and crime prevention.

3.2. Crimes Against Persons and Property

Crimes against persons and property involve illegal acts that either directly harm individuals or target their belongings (Barreda, 2023). These crimes impact personal safety and community security, making them a key concern for law enforcement and preventive measures like CCTV. From the responses, it is clear that CCTV often captures a wide range of crimes, from violent incidents such as injury and killing of persons to property-related offenses like theft and robbery. These crimes often occur at unexpected times, so constant monitoring and good-quality footage are essential for timely responses and investigations. Additionally, vehicle accidents and hit-and-run cases also appear frequently, showing how CCTV plays a crucial role in documenting both harm to individuals and property damage.

"From experience, the most common criminal activity captured in CCTV is the killing of persons using a firearm, shooting incidents, in short. Most of them happened back in the day. They were prevalent." (Police 1)

"Usually, the most common criminal activity captured in CCTV ranges from simple traffic violations to theft or robbery, and heinous crimes like murder, homicide, and sometimes a combination, like robbery with homicide. Those crimes are usually committed at the least expected times." (Police 2)

"The most common criminal activities that are commonly captured by CCTV in the Ozamiz area alone are vehicular accidents. Mostly, vehicle-to-vehicle, and sometimes vehicle against a pedestrian, hit and run, which might cause physical injuries to persons involved. Other than that, is theft or robbery." (Police 3)

The experience shared by the business owner supports the police responses by demonstrating how crimes against people and property are often captured on CCTV. In this case, the theft was directly captured on camera, which allowed the suspects to be identified and held accountable through official reporting and legal action. These incidents support the police findings that property crimes, along with violent and vehicle-related offenses, are often documented and provide useful evidence in investigations. This shows that CCTV not only discourages crime but also improves the justice process by offering clear records of illegal acts.

"We have direct experience of crime being committed against us, when my nephew visited our house, their branded footwear was stolen. It was captured by our CCTV, and we later filed a report at the police station. He was jailed for about three or six months, I think. The most common criminal activity captured by CCTV in our area is stealing. Just like recently, someone's wallet was stolen and we're told that it was thrown in a river, which happens to be near our house." (Establishment 3)

In summary, CCTV captures a wide variety of criminal activities, including violent acts such as the killing of persons, as well as property-related incidents like theft, robbery, and vehicle accidents that can harm people and possessions. These events often occur suddenly, exposing the everyday risks that individuals and communities encounter. Even minor cases, such as the theft of personal items, become significant when recorded by cameras. This footage provides strong evidence that can help hold offenders responsible. CCTV documents events, improves crime prevention, promotes public safety, and aids in solving criminal cases. It shows the importance of surveillance in providing clear accounts of what occurred, which reduces reliance on conflicting testimonies. CCTV contributes to creating a sense of security by assuring communities that illegal acts can be tracked and addressed.

Studies on crimes against people and property consistently show how important surveillance systems like CCTV are for both prevention and investigation. Research indicates that cameras can significantly lower the chances of offenses such as theft, robbery, and violent attacks because potential offenders are put off by the risk of being recognized (Yang et al., 2024). Other studies point out how CCTV footage strengthens the justice system by providing objective evidence that backs eyewitness accounts and aids in prosecuting cases (Brookman & Jones, 2022). Additionally, scholarly works recognize its role in monitoring urban areas, schools, and businesses, where it not only deters mischief but also helps identify security weaknesses that can be improved through better planning (Bagalanon et al., 2024; Folorunsho, 2021). These studies confirm that CCTV enhances public safety by protecting individuals, securing property, and backing effective law enforcement strategies.

The results emphasize that crimes against people and property are among the most commonly recorded incidents by CCTV. This includes violent acts like shootings and homicides, as well as theft, robbery, and vehicle accidents that can endanger lives and belongings. This shows how crucial surveillance technology is for providing reliable evidence, ensuring accountability, and shaping crime prevention strategies. It also indicates that while crimes can occur suddenly in everyday situations, having clear recordings boosts the ability to respond quickly and fairly. These findings stress the need for ongoing improvements in surveillance systems to better protect individuals, secure property, and foster safer community environments.

3.3. Technical Limitations of CCTV Systems

The technical limitations of CCTV systems highlight common issues that reduce the effectiveness of surveillance. These include poor video quality, limited storage capacity, weak lighting, connectivity problems, and faulty or broken units (Falangon, 2022). These challenges often make it hard for authorities and establishments to identify suspects accurately, retrieve reliable footage, and fully use CCTV for crime prevention and investigations (Kirui, 2024). The feedback from police officers shows that technical limitations are still a big concern in making the most of CCTV for crime investigations. They pointed out that poor video quality is one of the biggest problems. Unclear and pixelated footage complicates suspect identification, even with advanced tools. Connectivity problems, power outages, and limited storage capacity also disrupt the proper retrieval and preservation of evidence. Additionally, weak lighting, especially at night, further reduces camera effectiveness, making facial and plate recognition unreliable. Faulty or broken units in some places also obstruct access to critical footage when it's needed most. Overall, these limitations show the need for upgrading to high-definition cameras, improving infrastructure, and ensuring regular maintenance to boost the reliability of CCTV systems.

"Before, the qualities of CCTVs were poor, and it was really challenging for us investigators reviewing the footage. It makes the identification of suspects difficult." (Police 1)

"The challenge we usually encounter is the poor video quality of cameras, like when you zoom in on the footage, the image becomes pixelated. Even the cybercrime unit, at times, gets a hard time enhancing the image, so it's really advisable to install cameras with high definition. It's difficult unless there are eyewitnesses whose statements can corroborate the footage." (Police 2)

"In terms of challenges, in our Command Center, are probably in terms of connectivity and power outages. When that happens, it shuts down totally, which will prevent us from extracting the footage. Other problems include the storage, which is limited, and its capacity would only last for about 30 days. In line with the investigation, the challenge that I usually encounter is with the lighting, especially at night. Other CCTVs have poor image quality. So even if we have facial and plate number recognition, it would still be useless if the footage has poor image quality and the area where it was captured doesn't have sufficient lighting." (Police 3)

"The limitations that we usually encounter are the unavailability of footage because some CCTVs are broken, inoperative, or faulty in some establishments." (Police 4)

"During my time as in-charge personnel at the Command Center, the most common challenge I encountered was the lighting in some areas. The city is gradually increasing the installation of solar lights; however, not all of them can sustain for a longer duration, unlike other solar lights, which can light the streets even until morning. So, lighting is the problem." (Police 5)

The response from Establishment 3 echoes the police's concerns by pointing out similar technical issues that limit the effectiveness of CCTV systems. The establishment noted that, in addition to electricity problems, connectivity is a major challenge. Both modern and solar-powered CCTVs need a stable internet connection to work properly. This ties in with the police's observations about power outages and storage issues, demonstrating that without reliable infrastructure, surveillance becomes less trustworthy. Additionally, the establishment stressed the need to invest in CCTVs with night vision capabilities to tackle issues caused by poor lighting, a challenge mentioned by several police officers. This response supports the idea that improving technology and ensuring proper functionality are crucial for overcoming the technical barriers that diminish the role of CCTV in preventing and investigating crime.

"There are a few disadvantages of using modern CCTV cameras, aside from electricity, connection is also a problem. If you have no Wi-Fi, it can't operate. So do solar-powered CCTV cameras; they also need Wi-Fi… That's why I highly recommend, for those who are capable of making CCTV installations, choose a CCTV with a night vision feature." (Establishment 3)

To sum it up, technical limitations greatly affect how well CCTV systems work for crime prevention and investigation. One major issue is poor video quality. Footage often becomes pixelated when zoomed in, making it hard to identify suspects. This problem remains, even with technical help, since improving low-resolution images is tough and usually needs additional evidence. Connectivity and power interruptions can also cause significant setbacks. Outages or unstable internet connections may lead to lost or inaccessible footage. Limited storage capacity makes things worse, as recordings often get overwritten quickly. This restricts their usefulness in long-term investigations. Another common problem is inadequate lighting, especially at night. This reduces the clarity of recordings and makes features like facial recognition or license plate identification ineffective. Broken or faulty cameras in some locations add to these limitations, preventing access to important evidence on time. To tackle these issues, investing in high-definition cameras with night vision is vital. Ensuring stable power and internet connections and conducting regular system checks are also essential. If these technical barriers are not addressed, CCTV systems may not reach their full potential as reliable tools for security and accountability.

Studies on the technical limits of CCTV systems highlight how video quality, storage capacity, lighting, and connectivity affect their effectiveness in crime prevention and investigation (Falangon, 2022). Research shows that low-resolution cameras often fail to capture clear images of suspects or license plates, making evidence less trustworthy in court (Viswanathan et al., 2025). Studies also indicate that limited storage, particularly in older systems, results in the early loss of critical footage (Bacci et al., 2021). Additionally, insufficient lighting at night reduces image clarity and complicates accurate identification (Madhan & Shanmugapriya, 2024). Furthermore, frequent technical failures, such as broken cameras or poor connectivity, weaken surveillance coverage and delay

investigations (Nzesya, 2024; Singh et al., 2025). To solve these problems, establishments must invest in high-definition cameras with features like night vision, ensuring stable power and internet connections, and increasing storage capacities to keep recordings longer.

The findings suggest that while CCTV is a useful tool for crime prevention and investigation, ongoing technical limitations undermine its effectiveness. Poor image quality, inadequate lighting, limited storage, and connectivity issues lessen its reliability in identifying suspects and reconstructing events. These challenges imply that without proper investment in technology and infrastructure, CCTV systems may not achieve their intended goal of ensuring accountability and aiding law enforcement. The results also highlight the importance of regular maintenance, system upgrades, and strategic planning in deploying CCTV to address these weaknesses. Improving these technical aspects not only boosts the credibility of CCTV footage as evidence but also strengthens its role in promoting safety, deterring crime, and building public trust in surveillance systems.

3.4. Legal and Procedural Barriers to Accessing CCTV Footage

The legal and procedural barriers to accessing CCTV footage show the difficulties in obtaining surveillance recordings because of privacy laws and institutional protocols (Sijabat & Sirait, 2025; Baoyan, 2023). Although these barriers aim to protect data security, they often slow down investigations and delay the timely use of CCTV as evidence in solving crimes (Baoyan, 2023). Authorities stated that even in urgent situations, they cannot quickly access recordings from private businesses. They must first submit formal requests and get approval from management. In some cases, following the Data Privacy Act means they need to secure the owner's permission or even a court-issued warrant before reviewing footage. While these steps are important for protecting individual rights and privacy, they can also delay the swift resolution of cases where timely evidence is essential.

"Another thing is in the process of acquiring access to CCTV footage in establishments. Some of them, like several banks and malls, for example, even if we're the police, we always have to make a formal request first and get approvals from their heads or supervisors before we can look at their CCTV. That, sometimes, can hinder the speedy resolution of cases." (Police 1)

"In terms of the process, we can't just simply check the footage of private establishments without permission or a warrant because it might violate the Data Privacy Act, so it would depend on the owner if they permit us with our request. If not, we have to apply for a warrant from the court." (Police 2)

The establishment's response highlights the challenges mentioned by authorities. It confirms that access to CCTV footage is not given right away, even during law enforcement investigations. Establishments need police officers to officially request permission before they can review any recordings. In some cases, a warrant is also needed to meet legal requirements. This practice shows the need to balance cooperation with investigations and the protection of data privacy. However, it also points out how these procedures can delay the process of gathering important evidence. By supporting the police's viewpoint, the establishment's response indicates that while procedural safeguards are important, they can unintentionally slow down crime resolution.

"To your question, if it were the police that made a request, naturally, they would have to ask for permission first. If they do, we will allow them. But from what I know, the police will also bring a warrant if they want to look at the CCTV of private establishments." (Establishment 2)

In short, legal and procedural barriers significantly limit access to CCTV footage, affecting crime investigations. Before private establishment recordings can be reviewed, formal requests and administrative approvals are often needed. This adds time to processes where immediate action may be necessary. Compliance with data privacy laws prevents access to surveillance footage without proper authorization. Violating these laws can lead to legal issues. In many cases, investigators require the property owner's consent. If permission is denied, they must obtain a court-issued warrant, which adds more time. Although these safeguards protect individual rights and ensure careful handling of sensitive data, they often delay the retrieval of key evidence in urgent situations. This conflict between protecting privacy and allowing timely information access shows a need for clearer guidelines and streamlined procedures that balance security, legality, and efficiency.

Barriers to accessing CCTV footage highlight the ongoing struggle between protecting privacy and resolving crimes quickly. Strict data protection laws in many countries necessitate formal requests, owner consent, or court-issued warrants for accessing surveillance recordings (Jabbari, n.d.; National Privacy Commission, 2024; Sijabat & Sirait, 2025). These requirements often slow down investigations. While these rules protect citizens from misuse of personal data, they also limit immediate access to evidence in urgent cases (Baoyan, 2023). These studies emphasize the need to balance privacy protection with prompt evidence gathering to enhance the effectiveness of CCTV systems in preventing and solving crimes.

The findings indicate that while legal and procedural safeguards are necessary for protecting privacy and preventing misuse of surveillance data, they can also hinder the investigative process and limit the timely use of CCTV evidence. Delays from needing formal requests, owner consent, or court-issued warrants may impede swift action in urgent cases, potentially allowing offenders to avoid accountability. These insights underscore the need for clearer guidelines and streamlined protocols that weigh privacy rights against the urgent needs of law enforcement. Strengthening cooperation between establishments and authorities, along with developing standardized access procedures, could improve both efficiency and accountability in utilizing CCTV for crime prevention and investigation.

3.5. Reactive Backtracking and Suspect Identification

Reactive backtracking and suspect identification highlight the importance of CCTV in reviewing events and identifying individuals involved in crimes after they happen. CCTV provides a clear record of movements and incidents (Calimbo et al., n.d.; Kaur et al., 2023). This record is valuable evidence that helps investigations, backs up eyewitness accounts, and improves accountability in legal matters (Kirui, 2024). CCTV footage is key in solving cases. It allows investigators to track the movements of suspects before, during, and after a crime (Sobko & Tesliuk, 2024). According to police officers, this process is known as backtracking. It enables them to piece together the timeline of events and identify individuals who might have been involved or present at the scene. Even

when suspects cannot be fully identified, the footage still provides them with useful descriptions. When combined with eyewitness accounts, these descriptions strengthen the investigation. In addition to aiding inquiries, CCTV recordings are also acceptable evidence in court. This underscores their role as dependable documentation that supports accountability and ensures that cases rely on solid evidence instead of assumptions.

"Aside from the fact that it's a good deterrence, it also helps us resolve ongoing cases through its help in the identification of suspects as well as their movements before and after the commission of the crime." (Police 1)

"In times when a case is too complex or puzzling for the investigating officer, as to the identity of the perpetrator, with the help of CCTV, we can do the thing we call "backtracking". If there are incidents, we don't just look at the actual incident; we also consider the things that transpired leading up to that incident. That is called backtracking. Through it, we can identify possible persons with an interest in that particular incident. Even when we can fully identify the criminal, at least we can get a short description just by looking at the footage captured by CCTV together with eyewitness statements." (Police 2)

"It also aids us in investigations because it provides a record of the activities happening in a certain area. Since it provides a record, it can also be offered as evidence in court. It would be used as corroborative evidence." (Police 3)

The perspective from the establishment reinforces the points made about the value of CCTV in tracking down suspects and identifying them. It highlights CCTV's role as an objective and tireless recorder of events. Unlike human memory, which can be selective or unreliable, CCTV provides a consistent account of what really happened. This ability to capture details without interruption makes it a powerful tool for uncovering the truth behind incidents and supporting investigations with solid evidence. The statement also stresses the strength of visual documentation, pointing out that seeing the actual footage is more convincing than just verbal testimonies. In this way, the establishment's view supports the idea that CCTV acts as both a deterrent and an important resource for reconstructing events and ensuring accountability.

"Nevertheless, CCTV offers great help because it provides a record of events. It doesn't blink, unlike our eyes. And it also provides evidence as to what and how something had happened. As they say, 'To see is to believe' or 'a picture speaks louder than words'." (Establishment 4)

In summary, CCTV is a valuable tool for solving crimes. It discourages criminal behavior and provides clear records that help reconstruct events. Investigators can analyze the footage to track the actions of individuals before, during, and after an incident. This helps them piece together what happened and identify suspects. Even if full identification isn't possible, CCTV still gives useful descriptions that, along with other evidence, make the case stronger. Its ability to record events continuously and without bias is especially helpful. This reduces dependence on memory or conflicting statements. The footage can also act as supporting evidence in court, giving judges visual proof that backs up or refutes claims. Basically, CCTV's constant surveillance ensures that important details are kept, making it an essential tool in investigations and the quest for justice.

Backtracking and suspect identification highlight the important role of CCTV in piecing together criminal events and supporting investigations. Research shows that surveillance footage helps investigators track the movements of suspects and potential witnesses (Kirui, 2024). This provides context that goes beyond the incident itself. Even partial information, like physical descriptions or behavior patterns captured on camera, can significantly narrow down leads when combined with eyewitness reports (Aung & Kusakunniran, 2024). Moreover, studies stress that CCTV footage is valid evidence in court (Baoyan, 2023; Pei, 2025; Togatorop et al., 2020). Its objectivity supports legal processes by backing up testimonies and establishing timelines (Kirui, 2024). Overall, research confirms that CCTV improves investigative accuracy, assists in identifying suspects, and increases accountability (Brookman & Jones, 2022; Inzana et al., 2024). It is a crucial tool for both preventing and solving crimes.

The results indicate that CCTV is essential for enhancing investigations. It allows authorities to reconstruct events, identify suspects, and provide solid evidence for legal processes. Its role as an objective recorder of activities ensures that key details are preserved, which lessens reliance on inconsistent statements. This shows the need to maintain and upgrade surveillance systems to ensure clear and reliable footage that can be used as trustworthy evidence in court. Additionally, the findings suggest that incorporating CCTV into larger investigative strategies not only helps resolve cases but also promotes accountability and public trust in the justice system.

3.6. Proactive Real-time Monitoring and Dispatch

Proactive real-time monitoring and dispatch show the importance of watching CCTV footage closely to spot suspicious activities as they occur and respond right away. This method combines ongoing monitoring with quick communication and personnel deployment (Papale, 2024). It changes surveillance from merely reactive to a more preventive approach to crime. Proactive monitoring stresses the need for CCTVs to be observed in real time, allowing for quick detection and response to unusual activities (Piza & Moton, 2023). Continuous surveillance helps identify suspicious behavior before crimes escalate, so authorities can send personnel to the scene immediately (Papale, 2024). Regular system checks and reliable communication channels support this approach, ensuring that cameras work properly and responders can act quickly. By pairing constant vigilance with quick response strategies, proactive monitoring turns CCTV from a simple recording tool into a key part of crime prevention.

"CCTVs are more effective when manned. If unmanned, not monitored 24/7, the police would become reactive instead of proactive. Compared to manned CCTV, if there are suspicious persons or activity captured in a specific location, we can dispatch our patrolling officers to go and look after that area. There are times also, where criminals, despite knowing that there are CCTV, will still pursue their bad intentions. All they have to do is cover their faces with masks or even find ways not to be seen, just like what happened in Gaisano. If CCTVs are manned, at least we can thwart anyone with bad intentions from pursuing what they have in mind. That is crime prevention." (Police 2)

"Our most effective strategy would be the daily check-ups of CCTVs, if they're still functional, as well as the 24/7 monitoring of live footage. Since we have radio communication, if a suspicious activity is discovered, the response is quick." (Police 4)

"In terms of strategies, we assigned teams of personnel to monitor the CCTVs in the Command Center. So, once they notice any suspicious activity, they would communicate with us through our radio, and we can then go to the area." (Police 5)

The response from the establishment supports the idea of proactive monitoring by highlighting the importance of having more people and technology focused on potential risks. Real-time surveillance allows for a quick response to suspicious activity. Having additional staff provides immediate oversight that can deter or prevent crimes. The establishment also recognized that CCTV not only records incidents but also acts as a strong deterrent, discouraging individuals with bad intentions from acting out of fear of being identified. This view emphasizes prevention. Combining manpower with active surveillance creates a safer environment and lowers the chances of repeated incidents.

"Some strategies that we could use to prevent recurring incidents are hiring additional employees for additional eyes to watch over the restaurant. The restaurant is wide-open, so if there are more employees, there will also be more chances to mitigate the occurrence of crime…It's really useful to have CCTV because we can't predict if anything bad will happen, and it's useful to keep a record of the events. Aside from that, it's a highly effective deterrence. People with bad intentions will be prevented from committing a crime out of fear of being identified…." (Establishment 1)

To conclude, proactive real-time monitoring shows that CCTV should be used not just for recording but also as a tool for crime prevention. When surveillance systems are staffed around the clock, it is easier to spot suspicious behavior immediately. This allows authorities or staff to intervene before situations escalate. This approach shifts responses from reactive to preventive since monitoring teams can quickly send help to areas with unusual activity. Regular maintenance of cameras and ongoing checks of their functionality keep the system reliable and effective. Additionally, adding human oversight, like having staff watch and respond, enhances security by complementing the technology of CCTV. Beyond just capturing evidence, the visible presence of monitoring and extra supervision discourages people from committing crimes due to the fear of being caught. Together, these strategies show that combining technology with human attention improves the overall effectiveness of surveillance systems in ensuring safety and reducing crime.

Proactive real-time monitoring and dispatch highlights that surveillance systems work best when they include active human oversight and quick response strategies (Papale, 2024). Around-the-clock monitoring deters potential offenders, knowing that odd behavior will be noticed and acted upon quickly (Aballe et al., 2022). It is also crucial to couple CCTV with effective communication systems to facilitate rapid coordination between monitoring centers and staff on the ground (Kirui, 2024). Regular maintenance and removing blind spots help keep cameras reliable for detecting threats (Choi et al., 2023; Shukla et al., 2021). Overall, the literature confirms that active monitoring turns CCTV from a simple recording tool into an effective means for deterring crime, preventing incidents, and speeding up law enforcement responses.

The findings suggest that CCTV reaches its full potential when combined with proactive monitoring and quick response strategies rather than just being a passive recording system. Ongoing observation, regular maintenance,

and solid communication networks make it possible to spot and address suspicious activities before they turn into serious crimes. This method shows the need for enough manpower and resources to support monitoring efforts, along with investments in dependable infrastructure to maintain 24/7 operations. By merging technology with human awareness, surveillance systems provide not just evidence after incidents but also a strong means for deterrence and immediate action, ultimately enhancing public safety and building community trust.

3.7. Strategic Deployment of Resources

Strategic deployment of resources shows how information from CCTV footage guides the placement of security measures, staffing, and infrastructure upgrades in areas most at risk for crime. By pinpointing high-risk locations, examining criminal behavior, and studying movement patterns, CCTV helps create targeted plans that improve visibility, readiness, and safety (Kim et al., 2021; Maroma et al., 2024; Sobko & Tesliuk, 2024). CCTV plays a key role in guiding resource allocation by providing insights that help decide how and where to boost security measures. Analyzing surveillance footage allows authorities to identify high-risk areas and blind spots, enabling them to position cameras and deploy staff more effectively (Maroma et al., 2024). This information also helps in understanding criminal patterns and behaviors, leading to the development of proactive strategies to prevent future incidents (Sonowane et al., 2025). Additionally, CCTV data aids in operational planning by revealing essential details like entry and exit points and potential hiding spots, ensuring that responses are well-coordinated and thorough (Kirui, 2024). In summary, surveillance technology not only supports investigations but also shapes long-term planning to improve visibility and safety in vulnerable areas.

"Aside from being used as support in investigations, the information we obtained from it can give us directions on how to respond to specific incidents. Also, it can identify what needs to be improved in a particular location in terms of security." (Police 1)

"By analyzing CCTV, we can identify which areas are more prone to crime and which areas could be targeted by crime. Some criminals observe the activities of our police. If they knew when and where the police would be, they would target the area that doesn't have them. With that kind of information, we get from CCTV, we can create a plan on how to optimize police visibility." (Police 2)

"Based on observation, one successful strategy employed by the LGU is the installation of CCTVs in areas where it can be considered a blind spot if they weren't installed with CCTVs. That practice or strategy further strengthens the capacity of CCTV to identify individuals and to capture a wider view of a location… The information we obtained from CCTV footage is used, as mentioned earlier, to identify suspects, to track their movements, and to reconstruct the events that had occurred. It also helps us determine what other resources we should allocate when responding to a reported crime or incident." (Police 3)

"Other strategies we employ, of course, after careful study of areas where crimes or accidents usually occur, like on highways and in secluded places, CCTVs are installed there, as a result." "Because of it, we can study the behavior or specific movements of criminals, especially when we do backtracking. From that, we can create a plan to avoid something bad from happening again or prevent criminals from pursuing their intentions." (Police 4)

"Not only that, but by analyzing CCTV, if we were ever to conduct an operation in a particular area, the information about that location that we can obtain from CCTV would be beneficial in creating a comprehensive plan to effectively conduct the operation. Like, we can determine possible entry and exit points, where people could hide, and the like." (Police 5)

The response from the establishment backs up the points made about the smart use of resources. It shows how CCTV can help spot potential problem areas and shape preventive measures. In this case, surveillance helps identify where students might engage in negative behaviors. This information is used to decide whether to install more cameras, add staff, or look into other ways to improve safety. This reflects how CCTV is used more broadly to find high-risk spots and allocate resources better. It ensures that interventions are focused and effective. By connecting surveillance data to real actions, the establishment demonstrates that CCTV not only records incidents but also aids in proactive planning to improve security and avoid future problems.

"From my answer on the previous question, it really helps, especially if we could see that there are potential areas wherein the students could exhibit certain negative behaviors. It can add to strategic planning on whether to add more CCTV footage, to hire additional manpower, or to check if there are other means wherein the school could improve the safety and security of the learners." (Establishment 5)

To sum up, strategically using resources is one of the most important ways CCTV contributes to preventing crime and managing security. By studying surveillance footage, we can spot areas that are more at risk, like blind spots, isolated locations, or places where bad behavior often happens. This information helps decision-makers figure out where to install more cameras, assign staff, or upgrade infrastructure to boost overall security. Besides just placement, CCTV also aids in understanding criminal behavior and movements, which helps in creating focused strategies to prevent future incidents. The data collected can also aid in planning operations, like finding possible entry and exit points or spotting potential hiding places during enforcement actions. In institutional settings, this information can determine whether to extend surveillance coverage, increase staff, or introduce other safety measures to create a secure environment. CCTV shifts from merely recording to becoming a key tool that informs planning, resource use, and proactive actions aimed at improving safety and security.

Research on the strategic use of resources shows how essential CCTV is in helping make evidence-based decisions for enhancing security and safety. Studies find that surveillance systems can point out high-risk areas, allowing authorities to use manpower, infrastructure, and technology more effectively (Maroma et al., 2024). Research also highlights how CCTV facilitates the identification of blind spots, tracks criminal patterns, and watches vulnerable areas, guiding where safety measures should be prioritized (Eran & Hasranizam, 2024; Shukla et al., 2021). Additionally, studies indicate that data from surveillance not only supports immediate action but also aids long-term planning by offering insights for urban design, traffic management, and community policing efforts (Eran & Hasranizam, 2024; Tahir et al., 2023; Yang et al., 2024). Overall, findings show that CCTV improves efficiency in deploying resources, ensuring that security measures are focused and sustainable.

The results suggest that CCTV is not just useful for recording incidents; it also acts as a vital tool for planning and resource allocation in enhancing security. By identifying high-risk areas, monitoring behaviors, and exposing

operational blind spots, CCTV provides valuable data that can influence where to place cameras, assign personnel, and upgrade infrastructure. This ensures resources are used wisely, maximizing their effect on preventing crime and managing safety. The findings further emphasize the need to include CCTV analysis in long-term planning, as it encourages proactive steps instead of just reacting to events. The results imply that effectively using CCTV for strategic purposes strengthens security systems, increases readiness, and creates safer communities.

3.8. Technological and Infrastructure Enhancement

Technological and infrastructure enhancement focuses on upgrading CCTV systems with high-definition cameras, features like AI integration, and broader coverage to eliminate blind spots. It also highlights the need for regular training, research, and infrastructure support to boost the effectiveness of surveillance in preventing and investigating crime. Improving CCTV effectiveness requires both tech upgrades and better infrastructure. Adding cameras in blind spots and high-risk areas provides better visibility and deters crime (Lawrence et al., 2022). High-definition systems with zoom capabilities are recommended to enhance footage clarity. Integrating advanced technologies like artificial intelligence can help identify and track individuals more quickly (Pazho et al., 2023). Continuous staff training is crucial to ensure that those operating the CCTV can fully utilize its features and present findings effectively (Nugroho et al., 2023). Requiring both public and private facilities to adopt reliable surveillance systems strengthens community security, making CCTV more than just a tool for recording; it becomes a key measure in preventing and addressing crime.

"In relation to my answer, I think we should add more CCTV around Ozamiz, though, as I said that CCTVs are now everywhere, for me, if we really want to enhance their effectiveness, especially in investigations, then we should install more." (Police 1)

"To enhance the effectiveness of CCTV in crime investigation and intervention, owners of CCTV should identify and eliminate blind spots by installing more CCTV in their property. The quality should also be in HD and should be capable of zooming in and out. The flow of traffic on roads should also be studied so that backtracking would become easier by using CCTV. Training is also important. There should be seminars held annually, monthly, if possible, or any programs that refresh an officer's knowledge. Even now, there are still officers who remain traditional; officers should adapt as well." (Police 2)

"To enhance the effectiveness of CCTV, we must invest in the most up-to-date versions of CCTVs, not in the outdated type. I also believe that the city needs additional CCTVs. Also, maybe we can integrate AI with CCTV that can instantly recognize an individual with support from a database, like AFIS for fingerprints, for example. It would be easier and convenient. Training personnel are also important. Especially, when you get invited to court as an expert witness, how will you be able to explain your findings if you don't have knowledge or training with CCTV?" (Police 3)

"To enhance its effectiveness, I think we should install more CCTVs, not only to provide records of events but also to create deterrence. I also think that we should strictly require establishments, even private homes, to install CCTV. That would enhance their effectiveness." (Police 4)

"I also hope that one day, we can integrate AI with CCTV. It would be good if there were a program that could instantly recognize a person and track his or her location to eliminate the difficulty of doing backtracking." (Police 5)

The response from the establishment backs the call for better technology and infrastructure by stressing the need for ongoing research and innovation in CCTV systems. Just as there is a push to upgrade to high-definition and AI-integrated cameras, the establishment points out that new ideas and advancements can further improve the reliability and effectiveness of surveillance. The suggestion to install more cameras, especially in public spaces and on streets, fits with the broader view that expanding coverage boosts deterrence and provides greater security for communities. By supporting both innovation and wider deployment, the establishment emphasizes that effective CCTV systems need not only improved technology but also smart government investment in infrastructure.

"If I were to answer what needs to be done to enhance the effectiveness of CCTV, I would say that people should do more research about CCTV. Maybe from that, people could come up with new ideas that can enhance CCTV technology further… I strongly suggest that the local government should install more CCTV cameras around, corner to corner if possible, especially in the streets." (Establishment 2)

To conclude, improving CCTV effectiveness relies on technological upgrades and better infrastructure to boost quality and coverage. Adding more cameras, especially in public places and high-risk areas, increases visibility and reduces blind spots that criminals might exploit. Upgrading to high-definition systems with zoom features allows for clearer identification of people and vehicles. Integrating artificial intelligence enables real-time recognition and tracking, which simplifies incident investigations. Regular training programs are also important. They help personnel develop the skills necessary to maximize these technologies and accurately interpret data for investigations or legal cases. Establishing standard practices, along with ongoing research and innovation, can further enhance CCTV systems and assist them in meeting changing security needs. Additionally, encouraging private and public organizations to invest in modern surveillance builds a more connected safety network. This approach turns CCTV into not just a source of evidence but also a proactive tool for deterring crime and protecting communities.

Research on improving CCTV systems stresses the need for ongoing innovation to enhance their effectiveness in preventing and investigating crime. Upgrading to high-definition cameras with features like zoom, night vision, and wide coverage boosts the clarity and reliability of footage (Agurob et al., 2024; Kim et al., 2021; Valentino & Leonen, 2023). Researchers point to the growing potential of artificial intelligence, which allows for real-time facial and object recognition, automated alerts, and predictive mapping of crime (Ahmad, 2025; Pazho et al., 2023; Suthahar et al., 2025). They also emphasize the need to expand infrastructure by addressing blind spots, ensuring a steady power supply, and increasing data storage to prevent losing important evidence (Abd Rahim et al., 2025; Choi et al., 2023; Nikhilesh et al., 2022). Training and sharing knowledge are crucial for equipping users to operate modern systems effectively (Nugroho et al., 2023). These findings confirm that combining tech upgrades with

strong infrastructure and trained personnel improves the efficiency, accuracy, and deterrent value of CCTV systems.

These results suggest that without ongoing technological improvements and infrastructure upgrades, CCTV systems may struggle to meet today's security challenges. Investing in high-definition cameras, AI integration, and wider coverage can significantly enhance accuracy in identifying suspects, monitoring, and preventing crime. At the same time, boosting storage capacity, ensuring stable power and connectivity, and providing regular user training are vital for maximizing the system's potential. These results point to the need for both government and private sectors to prioritize modernizing surveillance as part of broader safety strategies. Improving CCTV technology and infrastructure not only strengthens its role as evidence in investigations but also boosts its preventive capacity, leading to safer communities.

4. Conclusion

The results showed that CCTV is highly effective at documenting traffic-related incidents and crimes against persons and property, supporting both investigations and preventive measures for public safety, while also proving its usefulness in retracing incidents and narrowing down possible offenders to add depth to investigations and ensure accountability. However, challenges like poor video quality, limited storage, weak lighting, and legal or procedural barriers limit its full potential in providing timely and reliable evidence. The findings emphasize the need for proactive monitoring, strategic use of resources, and ongoing improvements in technology and infrastructure to enhance CCTV's role in crime prevention, accountability, and community security.

This study filled the identified research gap on how CCTV crime analysis informs the design of targeted intervention schemes by establishing that CCTV footage does not only serve as passive evidence but actively guides law enforcement decision-making, operational planning, and intervention formulation. By showing how real-time monitoring, backtracking, and crime pattern analysis influence preventive and corrective actions, the study expands the practical understanding of CCTV as a dynamic tool in crime intervention rather than merely a surveillance device.

The study's findings have important implications ranging from strengthening legal frameworks and simplifying access procedures to CCTV footage to investing in technological upgrades and infrastructure support to maximize the benefits of surveillance systems. Policies aimed at ensuring inter-agency coordination, public-private partnerships, and standardized CCTV access protocols could greatly enhance the efficiency of crime response while protecting data privacy. Future research may utilize quantitative designs to measure the direct impact of CCTV-guided interventions on crime reduction rates, explore the integration of artificial intelligence in surveillance analytics, and examine community perceptions related to increased CCTV use. Longitudinal and comparative studies across different cities could provide deeper insights into the long-term effectiveness of CCTV-informed intervention strategies.

4.1. Future Suggestions

1. It is recommended to replace outdated cameras with high-definition units (night vision, wide angle, motion detection) and install additional CCTVs around highly crime-prone areas, blind spots, and poorly lit areas to improve surveillance coverage and deterrence.

2. Integrate artificial intelligence features like automated alerts, facial and plate recognition, and unusual behavior detection to improve the speed and accuracy of crime detection and suspect identification.

3. It would be beneficial to continue conducting specialized training in CCTV operations, video analysis, and digital forensics and partner with universities or tech providers for continuous learning and to ensure that each personnel possesses the required knowledge, skills, and competence.

4. Form a dedicated CCTV monitoring and analysis team with 24/7 staffing and hold simulation drills for monitoring, dispatch, and response.

5. Draft MOAs between police, local government unit, and establishments for evidence sharing to simplify legal procedures and ensure the timely acquisition of crucial video evidence.

6. Enactment of local ordinances requiring all privately owned establishments to install CCTV with minimum quality standards is also highly suggested.

5. Recommendations

Based on the results, it is recommended to improve CCTV effectiveness through a combination of technological, procedural, and strategic measures, which will enhance both crime prevention and law enforcement response, ultimately contributing to safer communities.

Technological Recommendations

Upgrading systems with high-definition cameras, night vision, and AI integration is recommended to be a priority. This will help overcome technical limitations and improve identification accuracy.

Procedural and Operational Recommendations

Regular maintenance and comprehensive staff training is recommended to ensure the reliability and proper operation of the system. Simplifying legal and procedural processes while maintaining privacy protections can also speed up access to important footage during investigations.

Strategic Recommendations

Expanding coverage to blind spots and high-risk areas are recommended to ensure broader protection and effective surveillance. CCTV data is recommended to be used for proactive strategies like real-time monitoring, strategic resource deployment, and infrastructure planning.

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The authors declare that they have no competing interests related to this work.

Consent for publication

The authors declare that they consented to the publication of this study.

Authors' contributions

All the authors took part in literature review, analysis, and manuscript writing equally.

Availability of data and materials

Supplementary information is available from the authors upon reasonable request.

Institutional Review Board Statement

Not applicable for this study.

Informed Consent

Informed consent was obtained from all participants, ensuring they participated voluntarily and understood the purpose of the study. Participants were assured that confidentiality would be respected, with stern measures taken to ensure their privacy and anonymity were safeguarded during the research process.

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