UDC 343.983:341.322.5
DOI: 10.63341/naia-chasopis/2.2025.22

Problematic aspects of using 3D scanners during the examination of war crime sites

Andrii Antoshchuk*
PhD in Law, Associate Professor
National Academy of Internal Affairs
03035, 1 Solomianska Sq., Kyiv, Ukraine
https://orcid.org/0000-0002-5088-4372

Lesia Patyk
PhD in Law, Associate Professor
National Academy of Internal Affairs
03035, 1 Solomianska Sq., Kyiv, Ukraine
https://orcid.org/0000-0002-3698-4799

Andrii Patyk
PhD in Law, Senior Research Fellow
National Academy of Internal Affairs
03035, 1 Solomianska Sq., Kyiv, Ukraine
https://orcid.org/0000-0003-2820-0250

Abstract
The application of modern technologies during crime scene examination primarily allows for reducing risks to life and health, which is extremely relevant in the extreme conditions of documenting war crimes. The aim of the study was to initiate a scientific discussion on the necessity of using 3D scanners during the examination of war crime scenes, to review the types of such technical means, and to specify their importance for documenting crimes for further use during pre-trial investigation and court proceedings. Based on the results of the research into scientific publications, it was established that the use of 3D scanners in modern practice during the examination of shelling sites, missile strikes, and other unlawful acts provides an opportunity to document the circumstances of a criminal event with subsequent reproduction using software. It was found that laser 3D scanners enable effective detection and documentation of war crime traces and other objects that can be attached to criminal proceedings as material evidence. A comparison of the results of various studies demonstrated that such tools indeed increase the effectiveness of war crime investigations. The analysed array of scientific sources indicates that the use of such technologies allows for more detailed documentation of the crime scene and modelling (through reconstruction, reproduction) of the circumstances of unlawful acts, which will enable the formation of a version of the event mechanism and the establishment of other circumstances relevant to criminal proceedings. The conducted review of scientific literature suggests that such equipment can be used to perform high-precision measurements and visualise the crime scene for

Article's History:
Received: 28.01.2025
Revised: 02.05.2025
Accepted: 27.05.2025

Suggest Citation:
Antoshchuk, A., Patyk, L., & Patyk, A. (2025). Problematic aspects of using 3D scanners during the examination of war crime sites. *Law Journal of the National Academy of Internal Affairs*, 15(2), 22-33. doi: 10.63341/naia-chasopis/2.2025.22.

*Corresponding author

repeated review and study of all its details, for conducting investigative experiments, and for presenting a 3D model of the war crime scene in court. The research results substantiate the necessity of involving a forensic specialist to document the examination of war crime scenes using 3D technologies

Keywords:
investigation; forensic tools; investigative (search) actions; software; 3D model

Introduction

In the context of armed aggression, the implementation of innovative technologies in the investigation of war crimes in Ukraine has seen rapid development. The use of modern technologies during crime scene examination allows for effectively eliminating the negative consequences of the event, documenting and subsequently reproducing a significant amount of the scene where unlawful acts were committed, quickly conducting necessary examinations, collecting material evidence, documenting the event without risk to life and health, and so on. One such technical tool is 3D scanners, which are actively used during the examination of war crime scenes. They allow not only for detailed documentation of the crime scene but also for subsequently manipulating the obtained information for its study, evaluation, and use in the investigation of such types of crimes. For example, M. Whelan *et al*. (2019), investigating explosion sites documented with 3D scanners, obtained results indicating the possibility of reproducing the mechanism of the event, modelling the dynamics and consequences of explosions, the trace pattern, and other data important for the investigation. There are also works by scientists N. Yalçın & P. Gençay (2024), who proved that documenting the examination using a laser scanner in combination with traditional documentation methods for three-dimensional crime scene reconstruction is effective. Alongside this, as R. Blahuta *et al*. (2024) note, the use of 3D scanning technologies is a unique way of recording information about a criminal offence, consisting of a virtual representation of the crime scene for subsequent access by all participants in the criminal process.

Ukrainian law enforcement agencies have experience working with such devices, but during the documentation of road traffic accidents and the investigation of some other types of criminal unlawfulness. However, in the current conditions of Ukraine, when sites of shelling, combat operations, terrorist acts, and other war crimes are to be investigated, such technical means perform extremely important tasks. Given the above, there is a need for scientific study of the types of 3D scanners, their implementation in the practice of war crime investigation, and the development of methodological recommendations for their application during investigative (search) actions, particularly crime scene examination.

The prospects and theoretical and applied aspects of using 3D scanners during the examination of criminal offence scenes attract the attention of a number of scholars. A. Kovalenko (2020a) considered the conceptual foundations of using a digital 3D model as a means of cognition and representation of signs of a criminal offence in criminal proceedings (in particular, the main methods of creating 3D models, directions of using 3D reconstruction (modelling). The researcher concluded that the use of 3D scanners during an examination makes it possible to create models of the scene for its repeated study and further planning of the investigation.

O. Romaniuk *et al*. (2022) noted that 3D scanning is effectively used in manufacturing, science, construction, design, business, and medicine. The scholar developed a classification of 3D scanners, paying special attention to stationary and portable devices, with different measurement sizes, panoramic, etc. He concluded that such technical means significantly facilitate the work of specialists in various fields of knowledge and are effective in investigating criminal offences. Continuing these studies, Polish scientists K. Kowalczewska & M. Nasiłowski (2025) also studied modern crime scene scanning technologies and argue that the use of 3D scanners negates manual measurements at the crime scene, especially in large areas, as such technologies create accurate orthophotoplans and maps to scale with high precision; the creation of layouts also becomes unnecessary, as scanners create 3D models of the crime scene.

N. Topchii (2024) conducted an analysis of 3D scanning technologies. Studying the types of such devices and methods of working with the obtained information, the scholar concluded that modern 3D scanners have the ability to digitise various objects – from microscopic details to large objects, which significantly expands the capabilities of various fields of knowledge, such as: medicine, jewellery, car manufacturing, forensics. Based on the results of the conducted research, the scholar states that contactless 3D scanners are effective for documenting various objects, as, unlike contact scanners, they do not alter the object of study. O. Dufeniuk (2024) considered 3D forensics in her works as an independent field of science, specifically raising questions about the essence of: 3D scanning, 3D reconstruction, 3D modelling, 3D mapping, 3D printing, and 3D animation. A similar understanding is demonstrated in the work of R. Carew *et al*. (2021). The scholars substantiated the creation of a field such as 3-D Secure (three-dimensional security) by the fact that it combines 3D methods and approaches borrowed from various sciences for crime scene reconstruction and visualisation (presentation) of evidence in court.

However, there are no fundamental works that would consider the wide accumulated experience in this field, including publications on individual aspects of 3D scanning. While theoretical literature focuses on conceptual problems, there is a need for an in-depth study of theoretical and applied aspects, which should be based on a systematic analysis of publications on the topic. It should be noted that as of 2025, the theoretical and methodological foundations and practical recommendations for the use of 3D scanners to ensure effective and high-quality crime scene examination require scientific development. Thus, the aim of the Article was to review the modern practice of using 3D scanners during the examination of war crime scenes.

The methodological basis of the study was the results of the analysis of scientific articles, monographs, and materials from international conferences concerning the use of 3D scanners in forensics, primarily published in the period since 2012. Sources were selected based on criteria of relevance, scientific value, authoritativeness of authors, and relevance to the topic. Particular attention was paid to publications concerning the documentation of war crime scenes, the analysis of types of 3D scanners, and the effectiveness of their use. Methods of analysis, comparison, classification, logical-semantic, and historiographical analysis were used. The structure of the presentation of the results corresponds to the directions of the scientific approach to the subject of research. The structural-functional method was also applied to reveal the role of 3D scanning in the pre-trial investigation process. The complex use of these methods allowed for the formation of a generalised approach to determining the significance of 3D technologies in forensics.

The concept and essence of 3D scanning

Since the beginning of Russia's full-scale invasion of Ukraine, war crimes have become widespread. According to the statistical data from the Office of the Prosecutor General of Ukraine for 2024, 28,788 crimes were registered, for which responsibility is provided under Article 438 of the Criminal Code of Ukraine[1]. However, an even larger number of such crimes were committed in 2022 (49,483 crimes) and 2023 (53,463 crimes) (General Prosecutor Office, 2024). Guided aerial bombs, various types of missiles, explosives attached to unmanned aerial vehicles (UAVs), and other weapons, even those prohibited by international treaties, are dropped on civilian populations and critical infrastructure. In 2024, over 1,300 UAVs, over 200 cruise missiles, 24 ballistic missiles, 22 aeroballistic missiles, and 7 hypersonic missiles were launched at Kyiv (Over, 1300 drones and over 250 missiles..., 2024). Such unlawful acts require proper documentation to form evidence for subsequent presentation in court. The most important investigative (search) action in this matter is the examination of the crime scene, as it reflects the initial situation left as a result of such terror. War crime scenes are quite specific, characterised by their scale of spread, the number of victims, significant destruction of buildings, and a specific trace pattern.

Conducting a qualified examination of war crime scenes requires not only highly professional competence but also the use of scientific and technical means for documenting and extracting forensically significant information. Since the scale of crime scenes resulting from shelling and other terrorist acts is sufficiently large, the technical means must be capable of encompassing and documenting the entire scene of the crime. 3D scanners are an effective tool, as they allow not only to document the crime scene but also to subsequently create a 3D model for visualising the committed act in court. This is confirmed by the research conducted by V. Giovanna *et al*. (2020), who concluded that 3D visual images significantly surpass the quality of crime scene photography and are much more effective for further study or investigation to establish forensic information. Also, V. Kornienko & T. Savchuk (2023), in revealing the tactical features of crime scene examination in combat conditions, concluded that only 3D modelling tools (3D scanners) allow for visualising the crime scene, detailing its individual components, and transmitting them in space and time. This is because 3D models are highly informative during mass shelling of civilian infrastructure, as they record details of object destruction in their most inaccessible places and reproduce them on a monitor screen in real sizes.

First and foremost, it should be noted that similar concepts of such devices exist in scientific literature. In particular, V.V. Baranchuk (2020) defines a 3D scanner as a technical device that allows, by collecting precise data, to create a three-dimensional digital model of an object, which can then be viewed and studied using software, and, if necessary, printed on a 3D printer. A. Haleem *et al*. (2022) define a 3D scanner as a non-contact, non-destructive digital device that uses a light line/laser to accurately transfer the shape of a physical object into computer-aided design (CAD) data. Such definitions not only outline the concept of the device itself but also encompass the entire process and purpose of its application. When it comes to its forensic application, the definition of a 3D scanner can be formulated as follows: it is a forensic-technical tool that allows for highly accurate documentation of crime scenes and the subsequent creation of their three-dimensional digital model for further study and analysis during pre-trial investigation and court proceedings.

The essence of 3D scanning lies in forming a high-resolution point cloud (each with three-dimensional coordinates) of scanned forensically significant

[1] Criminal Code of Ukraine. (2005, April). Retrieved from https://zakon.rada.gov.ua/laws/show/2341-14#Text.

objects, which, after processing, allows for opening a digital application using special software to create a 3D model. Such models allow not only to visualise the entire crime scene but also to thoroughly inspect various objects from different distances and angles, determine their size, shape, distance between objects, create digital copies of objects, and also reconstruct a damaged object, perform reverse modelling of objects for comparative examination, establish cause-and-effect relationships in a specific situation (situational modelling), and print specific prototypes of tools or other objects that carry forensic information. Using 3D scanning, one can create not only a model of the crime scene but also a 2D scheme, which is drawn up as an appendix to the inspection protocol. In combination with UAV scanning, it is possible to map large crime scenes (missile attacks, destruction of buildings and structures, etc.) (Urbanová *et al*., 2017; Dufeniuk *et al*., 2024). Furthermore, the use of such forensic-technical means for documenting war crime scenes allows for recording hard-to-reach places, large areas, and doing so quickly, mobiliy, with high accuracy, and from various angles to detail the crime scene.

Types and classification of 3D scanners

A considerable number of types and models of such devices have appeared on the Ukrainian market; they are all used in various fields for different purposes and with respect to different objects, and they also have different technical characteristics. Specifically, such devices can be divided into the following types: 1) optical (stationary with a tripod and mobile or handheld); 2) laser; 3) photogrammetric; 4) computed tomography (What are the types..., 2024). All of them can be used for forensic purposes. However, not all of them are used during pre-trial investigation, as they require significant financial support. It should be noted that some types, as of 2025, have been introduced into the activities of the Ukrainian police thanks to international partners.

Stationary optical 3D scanning involves placing an object on a special platform, which, when rotated around its axis, allows a conventional camera to take a series of photographs from one point at different angles. These images are subsequently "stitched" into a model. Such 3D scanning is ideal for clear visualisation of an object and its detailed examination on a computer. For example, British scientists W. Baier *et al*. (2018) proved the effectiveness of using stationary 3D scanning during a murder investigation. Specifically, by scanning the victim's skull using a micro-CT scanner, they visualised skull injuries and provided their dimensions to the pathologist for analysis of the fracture pattern, which made it possible to identify two assailants with different instruments used to inflict bodily harm. Using a similar method, these same scientists demonstrated the effectiveness of 3D visualisation during an investigation, but already of a road traffic accident scene (Baier *et al*. 2020). However, such scanners are not suitable for documenting war crime scenes due to their lack of mobility. They are more suitable for laboratory expert examination of certain processes and phenomena. For example, when modelling the structure of a missile or other ammunition, when modelling traces of trace evidence, or reconstructing a face from a skull, etc. A disadvantage of optical 3D scanners is the inability to decompose an electronic image into points and print it on a 3D printer due to the lack of precise coordinates for each point of the object.

Alongside this, the use of handheld optical 3D scanners is effective during crime scene examination. For example, Mantis Vision F6 SMART, F6 SR, and other similar devices from Mantis Vision. Such devices allow capturing high-resolution details and creating high-quality digital models, point clouds, and mesh models with photo-realistic textures. That is, this scanner allows converting scanned images from the scene into editable, accurate, and professional standard CAD files for use in Solidworks or other CAD software (F6 SMART™ Echo…, 2018).

For documenting war crime scenes, laser 3D scanners are preferred because they consist of a laser and an optical sensor, which allow projecting a laser beam and capturing the modified reflection of each line on the object being scanned (Ries, 2022). That is, such devices are effective at the scene not only for documenting the circumstances of the war crime but also for subsequently obtaining precise coordinates of each point of the object for further reproduction of the mechanism, for example, of a missile attack, where missile fragments scattered throughout the scene need to be assembled into a whole to understand exactly which missile was used, its technical characteristics, flight direction, and other circumstances important for the investigation.

Laser 3D scanners come in the following types: pulse-based laser and phase-shift-based laser. For example, the Trimble TX6 scanner is capable of measuring a million points per second, maintaining highly accurate data throughout its entire scanning range (Trimble TX6 laser scanner…, n.d.). Another example is the portable terrestrial laser 3D scanner Leica RTC360 with a built-in inertial system and automatic point cloud stitching function; it can scan both the general scene and the internal structure of individual objects, making it effective for documenting such investigative (search) actions (Leica RTC360 laser scanner…, 2022). Confirmation of the effectiveness of using such scanners comes from successful studies conducted by G. Baldino *et al*. (2023) on simulated indoor and outdoor crime scenes using virtual reconstruction of the examination with a Leica BLK360 laser scanner, controlled by Leica Cyclone software. As of 2025, these devices are available on the Ukrainian market and have excellent technical characteristics for documenting war crime scenes, however, they are quite expensive and law enforcement agencies are not sufficiently equipped with them.

T. Gandza & I. Petracov (2022) studied the possibilities of using laser 3D scanning in criminal proceedings, particularly during: ballistic, biological, trace evidence, dactyloscopic, anthroposcopic, and other examinations. The scholars stated that alongside the advantages of such scanners, there are also disadvantages in their operation, including the high cost of the devices themselves and their software, the need for special training to work with such devices, the absence of relevant trainers in Ukraine, etc. However, such disadvantages can be remedied and do not significantly affect the results of using such technical means during investigative (search) actions.

The next type of 3D scanners is photogrammetric. They are inexpensive and easy to use, consisting of a camera and photogrammetry software. As Ch. Villa & Ch. Jacobsen (2020) and V. Bilous & S. Bondar (2021) note, photogrammetry is a science that originated during World War I for precise measurements from photographs; modern photogrammetry is aimed at remotely determining quantitative and qualitative characteristics of objects (shape, size, position in space, etc.) based on measurements of photographic images of objects. This is confirmed by a comparative study by A. Sazaly *et al*. (2023), using the example of scanning an indoor crime scene with micro-unmanned aerial vehicles and traditional photography. From the obtained results, the scholars demonstrated that forensic photogrammetry and subsequent 3D model creation are much more effective than forensic photography. Also, scientists investigated the effectiveness of applying photogrammetry for forensic medical 3D documentation of crime scenes, evidence, and people.

As A. Kovalenko (2020b) and A. Mezhenin *et al.* (2021) assert, polyphotogrammetric photography appears to be the most promising today, capturing a large number of images of objects from the crime scene from different angles for subsequent computer analysis and obtaining their three-dimensional 3D model. In essence, polyphotogrammetry is one of the methods of contactless passive 3D scanning, where a point cloud of an object is created, but using a series of photographs (at least 20 images of one object with prior and subsequent frame overlap of 60%) and placing a forensic ruler next to the scanned object.

Compared to the use of forensic photography, photogrammetric scanning significantly facilitates the work of a forensic specialist in documenting war crime scenes. However, as of 2025, thanks to international partners, with the emergence of laser 3D scanners in the arsenal of law enforcement agencies, photogrammetric 3D scanning using digital cameras is losing its relevance. There are also comparative studies by M. Mehta (2020) on 3D laser scanning and photogrammetry methods, where the latter significantly loses in effectiveness. In contrast, scientists M. Esposito *et al*. (2023), after conducting a series of studies, concluded that photogrammetry focuses better on small details of objects at the crime scene, while laser scanning provides a more complete understanding of the geometry of the entire crime scene. The scientists proposed using both methods to cover large-scale crime scenes. Along with this, F.M. Sheshtar *et al*. (2025) argue that, compared to classical photogrammetry, modern mapping technology based on mobile phones equipped with the LIDAR (Light Detection and Ranging) program is effective. The results obtained by the scientists indicate that mapping using iPhone LIDAR is a very fast and effective tool for documenting unlawful acts, as for 5 seconds of operation, the error is only 0.1084 m. It should be noted that such an approach is quite controversial, as questions arise regarding providing law enforcement agencies with appropriate gadgets and programs. Another type of 3D scanner is computed tomography, which uses X-rays that pass through the scanned object and are subsequently registered by a sensor. This allows for documenting the internal geometry of the object. In combination with 3D printing, an object can be reproduced in a matter of hours. However, such devices are unsuitable for work in the field conditions of documenting war crimes.

Along with this, other divisions of 3D scanners are available in the scientific literature. In particular, A. Chan & O.N. Romaniuk (2020) proposed a general classification of laser 3D scanners: aerial, mobile, and terrestrial. Aerial scanners capture terrain from an aircraft. For example, if the crime scene is extensive and cannot be approached due to danger to life and health. Although these scanners can document a large area of the crime scene, they do not provide high accuracy due to the long distance from which the shooting is carried out. That is, this method of documenting the war crime scene can be used as an overview and orienting survey, but the subsequent 3D model produced will be inaccurate, without reproducing small details. Mobile scanners can collect data in dynamic mode using inertial and satellite navigation systems. The operation of scanners on the ground surface yields results similar to data obtained from terrestrial scanners. Scientists propose dividing terrestrial scanners according to several criteria (Table 1). I. Romanyshyn *et al.* (2012) adhere to the same approach, having developed a classification of 3D scanners much earlier, and it appears that it formed the basis for subsequent more modern scientific developments. As can be seen from the above, this is quite a comprehensive classification, and this is due to the fact that such devices are used in various fields of knowledge and have different tasks and capabilities.

In turn, the scholar V. Baranchuk (2020) in his work only presents a classification of 3D scanners by their method of information collection: contact (which mechanically touch the object being studied) and non-contact (which create a model remotely by directing a laser beam, light, or wave onto the object). The scholar very aptly distinguishes the following methods of scanning objects: a) aerial with UAV mounting (e.g., "YellowScan Surveyor"); b) terrestrial: tripod-mounted 3D scanner stations ("Faro Focus S Plus 350"), or portable handheld ("Artec Eva", "Scanner 3D-Forensics"), or stationary scanner ("Atos Scan box", "Solutionix D500"); c) mobile, mounted on a vehicle ("Leica Scan & Go LLR + LP16R"). This position of the scholar is quite accurate, as this division reflects the possibility of using such devices during the examination of war crime scenes.

Table 1. Classification of 3D scanners

Class	Classification criterion	Type
Terrestrial scanners	By installation method	Stationary: machine tools and coordinate measuring machines (horizontal, vertical, bridge and portal
		Portable
	By installation method of the object under study	Fully enclosed, where the object to be scanned is placed directly inside
		Partially enclosed, where the object to be scanned is placed on the scanner itself (such scanning will be effective for laboratory examination of forensically significant objects, rather than at the scene of the incident)
	By information collection method	Contact
		Non-contact or remote: active; passive (determine the spatial coordinates of points based on existing radiation): stereoscopic, photogrammetric and silhouette description scanners
Active 3D scanners	By physical signal type	Magnetic, ultrasonic, X-ray
		Holographic
		Projection (visible and invisible spectrum)
		Laser

Source: created by the authors based on A. Chan & O.N. Romaniuk (2020)

Scholars S. Verykokou & Ch. Ioannidis (2023) classified such devices into: contact and non-contact. However, they provide a rather detailed breakdown of laser scanners, specifically: triangulation (sending two laser beams that intersect at the object of interest), time-of-flight scanners (relatively slow as they measure the time required for a laser beam to travel the distance between the emitter and the target and return to the emitter), phase-shift scanners (using a continuous laser beam instead of discrete pulses), and structured light scanners (projecting a pattern onto the object using laser beams and studying the deformations caused by the object's shape with a camera). The latter are the most effective for documenting crime scene examinations because they are fast and capable of calculating the 3D position in space of many points simultaneously, not just one point.

Among the types of 3D scanners listed above, it should be noted that not all are suitable for forensic purposes, particularly for examining war crime scenes. For example, stationary scanners are generally unsuitable for on-site examination as they cannot be moved; handheld scanners cannot cover a significant area; and computed tomography scanners are quite expensive. Portable laser 3D scanners are best suited for the task of documenting war crime scenes, as they use a laser emitter and detector to calculate the distance and position of the scanned point, thus reproducing the scanned object as a whole. They are capable of accurately reproducing the entire crime scene, as well as its individual small objects. Also, as an option, for documenting individual traces at the scene (e.g., UAVs, missile parts, tyre tracks, footwear, the skull of a charred corpse, etc.), it is advisable to use handheld scanners.

The use of 3D technologies in criminal investigations

Until 2022, law enforcement agencies used 3D scanners during the examination of road traffic accident scenes. However, with the commission of various types of war crimes, the need increased to equip law enforcement agencies with appropriate technical means for documenting such unlawful acts. Thanks to volunteer assistance from Luxembourg, in 2022, employees of the National Police received thirty laser 3D scanners, which are used daily to document (scan) war crime scenes, particularly large areas. Thanks to these technical means, in the liberated territories, it is possible to scan the scene and objects in a few minutes, and the corresponding software allows processing the obtained information on a computer (Ries, 2022).

Furthermore, as stated in the publication Police to use 3D scanners to record consequences of Russian war crimes (2025), in November 2023, forensic specialists of the National Police from various regions of Ukraine underwent training and received "Z+F Imager 5016" laser 3D scanners from Polish authorities for examining war crime scenes. As of 2025, with the help of these devices, 3D models of the consequences of missile strikes on residential buildings and critical infrastructure, artillery shelling, bombings, and other Russian war crimes are created promptly, with minimal expenditure of effort and resources. The use of such technical means of documentation prevents the loss of material evidence during repeated shelling in the same areas (National Police forensic experts have mastered…, 2023). Considering the events outlined above, it can be confidently stated that police officers are equipped with such devices and competently use them during examinations.

The use of 3D scanners at the crime scene requires further processing of the obtained information. That is, software is used for processing, accumulating, copying, and transmitting the obtained forensically significant information. For example, the Mantis Vision Advanced Echo™ software suite is a set of tools for scanning and editing 3D models; specifically, after scanning, actions such as noise removal, editing, registration correction, mesh creation, file format conversion, and export can be performed. With Echo Software, the user can define geometric parameters, such as planes, lines, and points, and use this data for measurements with the highest level of accuracy, etc. (Echo Software 3D Scan…, 2020). In addition to this type of software package, there are others that perform approximately the same functions.

The use of 3D technologies in the investigation of criminal offences is a subject of discussion among many forensic scientists. The capabilities of such technologies prompt scholars to discuss the implementation of innovations in forensics. T. Wieczorek *et al*. (2019) conducted research on the use of 3D scanners for documenting crime scene examinations, as a result of which they established that the effectiveness of such scanning is influenced by factors such as: the characteristics of the crime scene surface, the distance from the scanner to the object, the actual accuracy of point measurement is affected by scanning density and operator competence, etc. In contrast, the research by R.M. Carew & D. Errickson (2020) showed that 3D-printed crime scene models are accurate (their copy is less than 1 mm (or 3%) deviation from the actual object), reliable, and reproducible models that can illustrate complex information as a physical demonstration in the courtroom. The accuracy of a 3D-printed image depends on factors such as image resolution, modelling parameters, and printer resolution.

R.M. Carew *et al.* (2021) and other scholars have long considered three-dimensional forensics (“3DFS”) as a separate field. In recent years, Ukrainian scholars have also brought this issue up for discussion. Thus, O. Dufeniuk (2024) in her work proposed to distinguish a new branch of forensic science and practice – 3D forensics. The scholar justifies this by the active use of 3D evidence in the investigation of criminal offences, obtained with the help of 3D scanning and the use of UAVs. The scholar highlights the areas of application of 3D technologies, specifically: during crime scene examination, examination of trace evidence, ballistic traces, bodily injuries, blood traces, facial reconstruction, and traffic accident circumstances. The scholar’s position seems somewhat debatable, as the directions during pre-trial investigation should be distinguished as follows: the application of 3D technologies during procedural (investigative) actions and during forensic examinations commissioned during the investigation of criminal offences. Therefore, the proposal to divide 3D scanners used during pre-trial investigation according to the following criteria seems correct: 1) during procedural actions: investigative (search) actions; conducting forensic examinations; 2) during investigative (search) actions: crime scene examination, investigative experiment; 3) during forensic examinations: trace evidence examinations, examination of weapons and ammunition, facial reconstruction, etc. The issue of using the appropriate type of scanner should be decided individually in each case by a specialist, taking into account the purpose of its application. For example, at a war crime scene, it is advisable to use a portable laser 3D scanner, and when examining objects in laboratory conditions – a stationary optical one, and so on.

The opinion of scholars V. Berezowski *et al*. (2020) and M. Daneshmand *et al*. (2018), who propose using geomatic methods such as total station, photogrammetry, aerial photogrammetry, laser scanners, and structured light scanners in combination for documenting large crime scenes, has the right to exist. They are capable of reproducing the details of the crime scene with maximum accuracy. In contrast, G. Galanakis *et al*. (2021) propose combining different 3D scanners for documenting crime scene examinations. For example, for high-quality documentation of an indoor crime scene, it is advisable to combine FARO Focus 3D X 330 and the handheld 3D scanner FARO Freestyle, and for documenting large outdoor crime scenes – aerial photogrammetry using several unmanned aerial vehicles and terrestrial laser scanning (FARO Focus S70). Researchers J.S. Cerreta *et al*. (2020) hold the same opinion; they conducted a comparative analysis of the quality of the transmitted image when documenting an examination using a UAV and a terrestrial FARO laser scanner, where the latter had an advantage. But the scholars do not deny the possibility of combining them for high-quality documentation of the examination.

Scholars R. Azmil *et al*. (2024) propose combining terrestrial laser scanning (TLS) and close-range photogrammetry (CRP), which will allow obtaining highly accurate 3D data during crime scene reconstruction by eliminating limitations such as device position, shadows, distance to the object, and laser beam angles that prevent the creation of a complete crime scene model. The same approach regarding the combination of several methods of crime scene documentation was followed by scholars M. Albeedan *et al*. (2024), whose work presents a new design of a mixed reality system using Microsoft HoloLens 2.0, adapted for work on a spatial 3D-scanned and reconstructed crime scene using a FARO X130 point cloud 3D scanner in combination with photogrammetry methods. The scholars A. Zappalà *et al*. (2024) should be positively noted for presenting a pre-trained Faster-RCNN model as the best method for studying objects at a virtual crime scene, their automatic recognition, classification, etc.

Continuing the discussion on the use of 3D technologies in the investigation of criminal offences, it should be noted that G. Teteratnik (2019), emphasising the importance of involving specialists who can quickly and efficiently document war crime scenes using 3D scanning, highlights the disadvantages of using 3D scanners such as: lack of funding, specialists knowledgeable in working with such devices, etc. However, it can be confidently stated that these disadvantages do not significantly affect the work of forensic specialists during examinations as of 2025. This is due to the arguments presented earlier in the Article and the provision of such devices to law enforcement agencies, and in turn, the conducted training of relevant specialists on how to work with them. And as of 2025, there should be no problems regarding the procedural formalisation of the use of such devices (technical means of documenting procedural actions), as Article 107 of the Criminal Procedure Code of Ukraine[1] does not contain a clear list of them but grants the right to the person conducting the examination to use them. Along with this, the issue of amending Article 105 "Appendices to protocols" of the Criminal Procedure Code regarding the addition of 3D models to the list of such appendices remains debatable, as proposed by G. Teteratnik (2019) and O. Dufeniuk (2024). The fact is that Part 2 of this Article states that appendices to the protocol may also include "other materials that explain the content of the protocol". That is, a 3D model falls precisely into this category of appendix. In contrast, O. Dufeniuk's (2024) proposal to amend Part 7 of Article 237 of the Criminal Procedure Code of Ukraine, by including 3D scanners as methods of documenting an examination, seems appropriate.

The conclusions drawn by scholars S. Pashchenko *et al*. (2023) regarding the necessity of creating a database of 3D models are fully justified and necessary for the investigation of war crimes. This is because it allows not only to improve the information systems of the National Police of Ukraine but also to conduct analytical work in the future, including identifying a common mechanism for committing such types of crimes, distinguishing types of instruments, etc. At the same time, it is possible to adopt the experience of European Union countries regarding the creation and use of the RISEN project (a consortium of research institutions, law enforcement agencies, and private companies, to develop real-time non-contact sensors to optimise the detection, visualisation, identification, and interpretation of traces at the crime scene). Scholars S. Villa *et al*. (2023) wrote about such a project in their works and proved that the training organised by RISEN allows law enforcement agencies to test their systems at simulated crime scenes, including scenarios such as murders, clandestine laboratories, and terrorist attacks.

Overall, the analysis of scientific sources indicates a high level of researcher interest in the implementation of 3D technologies in forensics and the gradual formation of approaches to their systematisation. Despite the diversity of technical solutions, most authors lean towards the expediency of combining different documentation methods to achieve maximum accuracy. A common feature is the recognition of the importance of 3D modelling as a means of visualising evidentiary information, which has the potential to be used both during investigative actions and in court proceedings. The emphasis is placed on institutional and regulatory challenges associated with the procedural formalisation of 3D materials. The issue of distinguishing 3D forensics as a separate direction within forensic science remains debatable, but relevant.

Conclusions

As of 2025, the Ukrainian market offers a wide range of three-dimensional scanners, differing in functional capabilities and scope of application. Within the existing interdisciplinary classification approaches, proposed classification of 3D scanners used with a forensic aims, according to the nature of their application, specifically during procedural actions, investigative (search) actions, and in the process of forensic expert activity. The study established the significance of using such devices for high-quality documentation of the situation at war crime scenes. In particular, the use of three-dimensional scanning technology during the documentation of the consequences of artillery shelling, missile strikes, and other unlawful acts allows for detailed and objective documentation of the situation at the crime scene with the possibility of its subsequent reconstruction using appropriate software, which is especially important in cases of significant territorial dispersion of the scene or the presence of factors of increased danger, such as mining, the risk of repeated shelling, or chemical contamination. Furthermore, the technology contributes to the detection and documentation of traces of criminal offences, as well as other material objects that can be recognised as material evidence in criminal proceedings, establishing the mechanism of the criminal event, formulating investigative versions, including individual circumstances, such as the direction of shelling or the number of hits, creating three-dimensional models (layouts) of the scene for further study, reconstruction of the situation and its visualisation in court proceedings, as well as establishing other circumstances relevant to a comprehensive, full, and impartial investigation of the criminal offence.

The available scientific literature on the topic of the Article is quite limited, as although this issue has interested forensic scientists in recent years, such devices have been in the minority in practice. Currently, 3D scanners themselves and their instructions have appeared, which allows for further scientific development in this direction, writing scientific articles,

[1] Criminal Procedure Code of Ukraine. (2012, April). Retrieved from https://zakon.rada.gov.ua/laws/show/4651-17#Text.

methodological recommendations, manuals, etc. The classifications of such devices are developed by engineering scientists, not forensic scientists. There are ongoing scientific discussions regarding the necessity of using such technical means during the examination of war crime scenes and crime scenes of general criminal orientation. However, there are a number of both procedural and forensic issues related to the use of 3D scanners, so the scientific discourse on this topic will continue.

Promising areas for further research on this topic may include works dedicated to the capabilities of 3D scanning of crime scenes, the algorithm of actions for a specialist working with such devices at the scene, and issues of developing a classification of 3D scanners with a forensic aims. Also, some aspects of the algorithm of actions for an investigator regarding the procedure for using such a method of documenting war crime scenes during pre-trial investigation and court proceedings require special attention from scientists.

Acknowledgements

Special thanks to the Armed Forces of Ukraine for the opportunity to develop a national criminalistics doctrine in the context of Russian military aggression.

Funding

The study was not funded.

Conflict of Interest

None.

References

[1] Albeedan, M., Kolivanda, H., & Hammady, R. (2024). Designing and evaluation of a mixed reality system for crime scene investigation training: A hybrid approach. *Virtual Reality*, 28, article number 127. doi: 10.1007/s10055-024-01018-8.

[2] Azmil, R., Mohd Ariff, M.F., Razali, A.F., Azmy, S.N., Darwin, N., & Idris, K.M. (2024). Transforming physical crime scene into geospatial-based point cloud data. *Engineering, Technology & Applied Science Research*, 14(3), 13974-13981. doi: 10.48084/etasr.6888.

[3] Baier, W., Donnelly, M.J., Payne, M., & Williams, M.A. (2020). A holistic multi-scale approach to using 3D scanning technology in accident reconstruction. *Journal of Forensic Sciences*, 65(5), 1774-1778. doi: 10.1111/1556-4029.14405.

[4] Baier, W., Warnett, J.M., Payne, M., & Williams, M.A. (2018). Introducing 3D printed models as demonstrative evidence at criminal trials. *Journal of Forensic Sciences*, 63(4), 1298-1302. doi: 10.1111/1556-4029.13700.

[5] Baldino, G., Spagnolo, E.V., Fodale, V., Pennisi, C., Mondello, C., Altadonna, A., Raffaele, M., Salmeri, F., Somma, R., Asmundo, A., & Sapienza, D. (2023). The application of 3D virtual models in the judicial inspection of indoor and outdoor crime scenes. *Advances and Applications in Geoforensics: Unraveling Crimes with Geology*, 101(1), article number A17. doi: 10.1478/AAPP.101S1A17.

[6] Baranchuk, V.V. (2020). 3D scanning as a method of crime scene fixation: Advantages and disadvantages. *Legal Bulletin*, 16, 280-286. doi: 10.32850/LB2414-4207.2020.16.01.

[7] Berezowski, V., Mallett, X., & Moffat, I. (2020). Geomatic techniques in forensic science: A review. *Science & Justice*, 60(2), 99-107. doi: 10.1016/j.scijus.2019.10.006.

[8] Bilous, V.V., & Bondar, S.P. (2021). *Photogrammetry: Tutorial*. Kyiv: Taras Shevchenko National University of Kyiv.

[9] Blahuta, R., Blikhar, V., & Dufeniuk, O. (2024). Transfer of 3D scanning technologies into the field of criminal proceedings. *Science and Innovation*, 16(3), 84-91. doi: 10.15407/scine16.03.084.

[10] Carew, R.M., & Errickson, D. (2020). An Overview of 3D printing in forensic science: The tangible third-dimension. *Journal of Forensic Sciences*, 65(5), 1752-1760. doi: 10.1111/1556-4029.14442.

[11] Carew, R.M., French, J., & Morgan, R.M. (2021). 3D forensic science: A new field integrating 3D imaging and 3D printing in crime reconstruction. *Forensic Science International: Synergy*, 3, article number 100205. doi: 10.1016/j.fsisyn.2021.100205.

[12] Cerreta, J.S., Burgess, S.S., & Coleman, J. (2020). UAS for public safety operations: A Comparison of UAS Point Clouds to terrestrial LIDAR Point Cloud Data using a FARO Scanner. *International Journal of Aviation, Aeronautics, and Aerospace*, 7(1). doi: 10.15394/ijaaa.2020.1432.

[13] Chan, A., & Romaniuk, O.N. (2020). Analysis of 3D scanning devices. In *Materials of the XLIX scientific and technical conference of the divisions of Vinnytsia National Technical University* (pp. 231-234). Vinnytsia: Vinnytsia National Technical University.

[14] Daneshmand, M., Helmi, A., Avots, E., Noroozi, F., Alisinanoglu, F., Arslan, H.S., Gorbova, J., Haamer, R.E., Ozcinar, C., & Anbarjafari, Gh. (2018). 3D Scanning: A comprehensive survey. *Computer Vision and Pattern Recognition*. doi: 10.48550/arXiv.1801.08863

[15] Dufeniuk, O. (2024). The future of 3D forensics: Innovations changing pre-trial investigation practices. *Legal Scientific Electronic Journal*, 3, 457-460. doi: 10.32782/2524-0374/2024-3/110.

[16] Dufeniuk, O., Melnyk, N., Nahorniak, Yu., & Melnyk, S. (2024). Innovative potential of 3D technologies in crime investigation. *Social and Legal Studios*, 7(4), 222-230. doi: 10.32518/sals4.2024.222.
[17] Echo Software 3D Scan and Edit Software Application User Guide. (2020). *Confidential. Doc. Catalog Number: MNI-000004. For Echo™ Software Version: 2.0.0 P. 316*. Retrieved from https://mantis-vision.com/wp-content/uploads/2020/02/Mantis-Vision-Echo-Software-User-Guide-Rev.-3.0.3.pdf.
[18] Esposito, M., Sessa, F., Cocimano, G., Zuccarello, P., Roccuzzo, S., & Salerno, M. (2023). Advances in technologies in crime scene investigation. *Diagnostics*, 13(20), article number 3169. doi: 10.3390/diagnostics13203169.
[19] F6 SMART™ Echo. Volumetric handheld camera. User guide. (2018). Retrieved from https://www.manualslib.com/manual/1390438/Mantis-Vision-F6-Smart-Echo.html.
[20] Galanakis, G., Zabulis, X., Evdaimon, T., Fikenscher, S.-E., Allertseder, S., Tsikrika, T., & Vrochidis, S. (2021). A study of 3D digitisation modalities for crime scene investigation. *Forensic Science*, 1(2), 56-85. doi: 10.3390/forensicsci1020008.
[21] Gandza, T.V., & Petracov, I.V. (2022). On the achievements and prospects of using the latest technologies in the investigation of crimes. In *Modern trends in the development of forensics and criminal proceedings under martial law* (pp. 126-128). Kharkiv: KhNUVS. doi:10.5281/zenodo.7339681.
[22] General Prosecutor Office. (2024). *Unified report on criminal offenses for January-December, 2023*. Retrieved from https://gp.gov.ua/ua/posts/pro-osib-yaki-vchinili-kriminalni-pravoporushennya-2.
[23] Giovanna, V., Devlin, J., Watson, J., Kenyhercz, M., & Keller, J. (2020). *Final summary report research & development in forensic science for criminal justice purposes*. Knoxville: The University of Tennessee.
[24] Haleem, A., Javaid, M., Singh, R.P., Rab, Sh., Suman, R., Kumar, L., & Khan, I.H. (2022). Exploring the potential of 3D scanning in Industry 4.0: An overview. *International Journal of Cognitive Computing in Engineering*, 3, 161-171. doi: 10.1016/j.ijcce.2022.08.003.
[25] Kornienko, V.V., & Savchuk, T.I. (2023). Tactical features of conducting an inspection of the scene of an incident in conditions of combat operations. *Bulletin of the Criminological Association of Ukraine*, 2(29), 165-179. doi: 10.32631/vca.2023.2.12.
[26] Kovalenko, A.V. (2020a). Conceptual principles of using a digital 3D model as a means of identifying and displaying signs of a criminal offense. *Forensic Science and Forensic Examination*, 66, 420-430. doi: 10.33994/kndise.2021.66.41.
[27] Kovalenko, A.V. (2020b). Photogrammetric method of forensic photography. *The Journal of V.N. Karazin Kharkiv National University*. *Series: "Law"*, 29, 253-260. doi: 10.26565/2075-1834-2020-29-34.
[28] Kowalczewska, K., & Nasiłowski, M. (2025). Polish insights into forensic technology: The role of 3D scanners in crime scene investigations and international criminal justice. *Forensic Science*, 1, 32-39. doi: 10.32782/forensic.science.2025.1.5.
[29] Laser scanner Leica RTC360. Leica Geosystems. (2022). Retrieved from https://leica-geosystems.com.ua/product/rtc360/.
[30] Mehta, M. (2020). 3D reconstruction of crime scene – a comparative study between 3D laser scanning and photogrammetry techniques. *Mendeley Data*. 6. doi: 10.17632/89rttg3x6m.1.
[31] Mezhenin, A., Polyakov, V., Prishhepa, A., Izvozchikova, V., & Zykov, A. (2021). Using virtual scenes for comparison of photogrammetry software. In Z. Hu, S. Petoukhov & M. He (Eds.), *Advances in intelligent systems, Computer science and Digital Economics II. CSDEIS 2020. Advances in intelligent systems and computing, vol 1402* (pp. 57-65). Cham: Springer. doi: 10.1007/978-3-030-80478-7_7.
[32] National Police forensic experts have mastered the latest 3D scanners for examining the sites of hostilities and terrorist attacks. (2023). Retrieved from https://sud.ua/uk/news/ukraine/286632-kriminalisty-natspolitsii-ovladeli-noveyshimi-3d-skanerami-dlya-osmotra-mest-boevykh-deystviy-i-teraktov.
[33] Over, 1300 drones and over 250 missiles of various types attacked Kyiv in 2024, – KMVA. (2024). Retrieved from https://novynarnia.com/2024/12/30/ponad-1300-droniv-i-ponad-250-raket-riznogo-typu-atakuvaly-kyyiv-u-2024-mu-kmva/.
[34] Pashchenko, S.V., Shulhin, A.A., & Kharchenko, V.O. (2023). Conceptual foundations of applying innovative 3d scanning technologies in the context of maintaining airworthiness of state aviation equipment. *Collection of Scientific Papers of the State Research Institute of Aviation*, 19(26), 150-155. doi: 10.54858/dndia.2023-19-21.
[35] Police to use 3D scanners to record consequences of Russian war crimes. (2025). Retrieved from https://www.ukrinform.ua/rubric-society/3791667-policia-zastosovuvatime-3dskaneri-dla-fiksacii-naslidkiv-voennih-zlociniv-rosian.html.
[36] Ries, J. (2022). *Luxembourgish 3D scanners to help uncover war crimes committed by Russians in Ukraine*. Retrieved from https://today.rtl.lu/news/luxembourg/a/1991443.html.
[37] Romaniuk, O.N., Slukovska, A.U., & Romaniuk, N.V. (2022). Analysis of 3D scanners. In *State, achievements and prospects of information systems and technologies* (pp. 174-177). Odesa: ONAKHT.

[38] Romanyshyn, I., Malitsky, A., & Lozinsky, A. (2012). Classification and main characteristics of ground-based 3D scanners. *Modern Achievements of Geodetic Science and Production*, 2(24), 69-74.

[39] Sazaly, A.N., Ariff, M.F.M., & Razali, A.F. (2023). 3d indoor crime scene reconstruction from Micro UAV Photogrammetry technique. *Engineering, Technology and Applied Science Research*, 13(6), 12020-12025. doi: 10.48084/etasr.6260.

[40] Sheshtar, F.M., Alhatlani, W.M., Moulden, M., & Kim, J.H. (2025). Comparative analysis of LiDAR and photogrammetry for 3D crime scene reconstruction. *Applied Sciences*, 15(3), article number 1085. doi: 10.3390/app15031085.

[41] Teteratnik, G.K. (2019). Regulatory and organizational-legal issues of conducting an inspection of event venues in the territory of joint forces operations. *South Ukrainian Legal Journal*, 4(3), 64-67. doi: 10.32850/sulj.2019.4.3.15.

[42] Topchii, N. (2024). 3D scanners. Principles of operation and analysis of the current state. *Academic notes of the V.I. Vernadsky TNU. Series: Technical Sciences*, 35(74), 6, 25-29. doi: 10.32782/2663-5941/2024.6.1/05.

[43] Trimble TX6. 3d scanner. Getting started guide work. Official master distributor in Ukraine of the company Trimble Navigation. (n.d.). Retrieved from https://kmcgeo.com/ua/lazernye-skanery/3d_tx6/.

[44] Urbanová, P., Jurda, M., Vojtíšek, T., & Krajsa, J. (2017). Using drone-mounted cameras for on-site body documentation: 3D mapping and active survey. *Forensic Science International*, 281, 52-62. doi: 10.1016/j.forsciint.2017.10.027.

[45] Verykokou, S., & Ioannidis, Ch. (2023). An overview on image-based and scanner-based 3D modeling technologies. *Sensors*, 23(2), article number 596. doi: 10.3390/s23020596.

[46] Villa, C., & Jacobsen, C. (2020). *The application of photogrammetry for forensic 3D recording of crime scenes, evidence and people*. Cham: Springer. doi: 10.1007/978-3-030-24330-2_1.

[47] Villa, C., Lynnerup, N., & Jacobsen, C. (2023). A virtual, 3D multimodal approach to victim and crime scene reconstruction. *Diagnostics*, 13(17), article number 2764. doi: 10.3390/diagnostics13172764.

[48] What are the types of 3D scanners? (2024). Retrieved from https://3dees.kiev.ua/faq/82-jake-jsou-typy-3d-skeneru/.

[49] Whelan, D., Weggel, D., Moss, J., & Howe, A. (2019). *Post-blast investigative tools for structural forensics by 3D scene reconstruction and advanced simulation*. Retrieved from https://www.ojp.gov/pdffiles1/nij/grants/252954.pdf.

[50] Wieczorek, T., Przyłucki, R., Lisok, J., & Smagór, A. (2019). Analysis of the accuracy of crime scene mapping using 3D laser scanners*. Methods and Techniques of Signal Processing in Physical Measurements. Lecture Notes in Electrical Engineering*, 548, 406-415. doi: 10.1007/978-3-030-11187-8_33.

[51] Yalçın, N., & Gençay, P. (2024). Three-dimensional reconstruction of a shooting crime scene. *Edelweiss Applied Science and Technology*, 8(5), 549-567. doi: 10.55214/25768484.v8i5.1717.

[52] Zappalà, A., Guarnera, L., Rinaldi, V., Livatino, S., & Battiato, S. (2024). Through virtual reality and deep learning techniques. *Computer Vision and Pattern Recognition.* doi: 10.48550/arXiv.2409.18458.

Проблемні аспекти використання 3D сканерів під час огляду місць воєнних злочинів

Андрій Антощук
Кандидат юридичних наук, доцент
Національна академія внутрішніх справ
03035, пл. Солом'янська, 1, м. Київ, Україна
https://orcid.org/0000-0002-5088-4372

Леся Патик
Кандидат юридичних наук, доцент
Національна академія внутрішніх справ
03035, пл. Солом'янська, 1, м. Київ, Україна
https://orcid.org/0000-0002-3698-4799

Андрій Патик
Кандидат юридичних наук, старший дослідник
Національна академія внутрішніх справ
03035, пл. Солом'янська, 1, м. Київ, Україна
https://orcid.org/0000-0003-2820-0250

Анотація
Застосування сучасних технологій під час огляду місця події дає змогу насамперед знизити ризики для життя та здоров'я, що надзвичайно актуально в екстремальних умовах фіксації воєнних злочинів. Метою дослідження було розгорнути наукову дискусію щодо необхідності використання 3D сканерів під час огляду місць вчинення воєнних злочинів, розглянути види таких технічних засобів і конкретизувати значення їх для фіксації злочинів з метою подальшого використання під час досудового розслідування та судового розгляду. За результатами дослідження наукових публікацій було встановлено, що застосування 3D сканерів у сучасній практиці під час огляду місць обстрілів, ракетних ударів та інших протиправних дій надає можливість зафіксувати обстановку кримінальної події з подальшим відтворенням за допомогою програмного забезпечення. З'ясовано, що за допомогою лазерних 3D сканерів здійснюють ефективне виявлення та фіксацію слідів воєнних злочинів та інших об'єктів, що можуть бути долучені до матеріалів кримінального провадження як речові докази. Порівняння результатів різних досліджень дало змогу встановити, що такі засоби справді підвищують ефективність розслідування воєнних злочинів. Проаналізований масив наукових джерел засвідчує, що використання таких технологій надає можливість детальніше зафіксувати обстановку місця події та змоделювати (шляхом реконструкції, відтворення) обстановку протиправних дій, що уможливить формування версії про механізм події, встановлення інших обставин, що мають значення для кримінального провадження. Здійснений огляд наукової літератури дає підстави стверджувати, що за допомогою такого обладнання можна провести вимірювання високої точності й візуалізувати місце події для повторного перегляду та вивчення всіх його деталей, для проведення слідчого експерименту, а також для представлення 3D моделі місця вчинення воєнного злочину в суді. Результати дослідження обґрунтовують необхідність залучення спеціаліста-криміналіста для фіксації огляду місць подій воєнних злочинів за допомогою 3D технологій

Ключові слова:
розслідування; техніко-криміналістичні засоби; слідчі (розшукові) дії; програмне забезпечення; 3D-модель