



Ethical and safety implications of artificial intelligence-driven surveillance on construction sites in Nigeria: a case study approach

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ABSTRACT

In Nigeria today, there is a significant shift happening in the construction industry in Nigeria due to the rising use of technologies associated with Artificial Intelligence (AI), which are designed to improve productivity, efficiency, and safety performance. Surveillance technologies that involve computer vision, smart cameras, drones, sensors, machine learning, and predictive analytics become more and more popular among construction project managers. Certain opportunities exist for the application of those technologies in order to detect threats, observe behavior, prevent accidents and make sure that the safety regulations are adhered to. However, the use of AI surveillance technologies poses many ethical and safety concerns about the protection of privacy, worker autonomy, data ownership, algorithmic bias, cyber-security, and the creation of highly monitored workplaces. The paper explores the ethical and safety issues raised by the implementation of AI-based surveillance systems at construction sites. This research will analyze the connection between technological innovation and responsible safety management from the perspective of construction professionals, employees, and organizational stakeholders. This research is based on the qualitative methodology with the use of case studies along with a literature review, which will include information on the use of artificial intelligence, construction safety management, workplace surveillance, and responsible governance of technology. It has been found that artificial intelligence-based workplace surveillance has a huge potential for improving construction safety as a result of hazards early detection, predictive risk assessment, and regulatory compliance. But at the same time, the lack of responsible ethical frameworks can harm the trust of workers, raise issues about the breach of their privacy, as well as increase problems related to transparency and accountability. The research findings highlight the need to apply a human-centered approach to the use of artificial intelligence in construction, meaning that technologies should be used to help professionals and workers in making decisions.

1. Introduction

The construction sector is still one of the most economically relevant industries across the world, and it is highly essential in infrastructure creation, job creation, and economic development of any country. Nevertheless, despite modernization of technologies and enhancement of occupational health and safety management techniques, the construction industry experiences many workplace hazards caused by complicated working conditions, temporary nature of projects, operation of machinery and interaction of people and dangerous machinery. It is reported that the hazards faced by construction workers include falls from heights, struck-by injuries, equipment malfunction and risky behavior of workers.

For the longest time, construction safety management has been characterized by inspections, safety training, manual observation, and corrective measures following identification of hazards. Unfortunately, these have proved to be reactive measures that are constrained by the

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limited capacities of human beings and other factors like late responses. According to Eduprojectsng (2026), the advent of Artificial Intelligence (AI) brings new opportunities for making a shift from reactive approaches to construction safety management.

AI-driven surveillance system is Without a doubt one of the fastest evolving applications of artificial intelligence inside construction sites. By combining computer vision, Internet of Things (IoT) devices, machine learning models, and automated analytics, AI can keep a watchful eye on construction work at all times and point the potential dangers right away. Smart surveillance systems can check the use of personal protective equipment by workers, detect unsafe closeness of workers and machines, supervise forbidden areas, and even foresee accidents that could happen.

The rising use of artificial intelligence technology in emerging economies like Nigeria is indicative of global trends towards digital transformation. According to Ekwueme (2025), in his study on the effectiveness of artificial intelligence technology by engineers in manufacturing firms in Nigeria, AI plays an important role in enhancing efficiency, technology skills, and performance. This shows that professionals in the Nigerian industries are gradually becoming aware of the benefits of using AI technology.

In the same way, studies analyzing the impact of artificial intelligence on the organizational performance in Nigeria show that the use of AI increases competitiveness, automation and effectiveness in operations. But at the same time, the research identifies various challenges in implementing AI, such as technological preparedness, adaptation of employees and issues related to governance. Such challenges apply especially to the construction industry since AI surveillance impacts workers directly (Eduprojectsng 2026).

Despite the many advantages of AI-powered surveillance, there are certain ethical concerns raised by its deployment, which need to be analyzed in detail. The construction workers might view constant surveillance as being invasive of their privacy or as a way of undermining their autonomy at work. There are issues concerning the ownership of surveillance data, its duration, and the reliability of AI-generated decisions. There is also the risk of algorithm errors leading to discriminatory treatment of workers (Zhang et al, 2015).

An ethical component of AI surveillance is thus becoming ever more relevant. The task of safety technology at workplaces is to ensure the safety and improved working conditions for workers and not an overly surveyed and controlled environment. An ethical approach to AI development demands that it be transparent, accountable, under human control, and engage with workers.

The current study explores the ethical and safety considerations related to AI-enabled surveillance in construction projects through the use of a case study methodology. This research adds to the expanding literature on the responsible use of artificial intelligence in construction management, especially in the context of developing nations experiencing rapid digitization.

1.1. Statement of the Problem

The construction sector is still grappling with several safety problems associated with risky working environments, poor risk monitoring, and inefficiencies of conventional safety management systems. Despite the promise offered by AI-powered surveillance tools in terms of detecting hazards, enhancing safety compliance, and accident prevention, the use of such technologies in construction sites poses several ethical and practical questions. Problems concerning the privacy of construction workers, data security, transparency, trust issues, AI bias, and decision-making have not been properly addressed. In addition, lack of knowledge about the perceptions of construction workers towards AI surveillance could hinder its successful implementation. Thus, this research attempts to explore the impacts of AI-based surveillance systems on construction sites regarding safety and ethics issues in order to promote a good use of AI that contributes to improved safety performance without compromising workers' rights and organizational trust.

1.2. Objectives of the study

The specific objective of the study are to:

1. Analyze the effects of AI-based surveillance systems on the safety performance in the construction industry, focusing on the detection of hazards, accidents prevention, proper use of personal protective equipment, and emergency response.
2. Analyze the ethical issues of AI-based surveillance in construction, highlighting issues of workers' privacy, security of information, accountability, and proper use of surveillance information.
3. Analyze the effect of AI-based surveillance on worker trust in technology, trust in organization, and construction organizations' safety culture.

2. Literature Review

2.1 Theoretical Framework

2.1.1 Technology Acceptance Model (TAM)

Based on the Technology Acceptance Model proposed by Davis (1989), the adoption of technology is based primarily on the level of perceived usefulness and ease of use. In the construction sector, the use of AI will be accepted only if it is viewed as safety-focused technology and not just management-focused. Importance of the Theory of Acceptance and Use of Technology to the study can be attributed to the fact that it can help establish how employees' perceptions determine whether AI surveillance systems will be successfully implemented. In cases where construction employees find AI surveillance technologies helpful in the prevention of accidents, hazard identification and improvement of work safety, they are more inclined to accept such technologies. However, concerns about privacy violation, over-surveillance, data manipulation, and opacity of these surveillance processes might affect technology acceptance.

Moreover, TAM theory underscores the significance of involving users in technology implementation process, training users as well as communicating with them during technology implementation process. As a result, in order for the objective of AI surveillance systems to be achieved (work safety), organizations should ensure that workers are aware of the purpose and benefits of these technologies.

2.1.2 Artificial Intelligence and Digital Transformation in Construction

As Pan and Zhang (2021) explain, artificial intelligence has emerged as a significant factor of innovation in the field of construction engineering and management since it allows companies to analyze a great amount of project-related data, forecast possible risks, and optimize operations. AI technology can be applied in project scheduling, cost estimating, quality control, and safety monitoring.. The use of artificial intelligence in engineering and industry settings has shown great prospects in increasing efficiency and decision making. As pointed out by Ekwueme (2025), in the research on the efficiency of artificial intelligence among engineers in manufacturing companies in Nigeria, the role of artificial intelligence is becoming increasingly important as far as improving professional operations and performance is concerned. The usage of artificial intelligence in manufacturing serves as a conceptual basis for the development of similar technology in order to help the construction process via automated surveillance, risk detection, and enhanced workflow management. In construction settings, AI surveillance will be able to help the manager detect any unsafe behavior and predict accidents.

Construction industry has traditionally encountered challenges in ensuring consistency in safety performance due to constantly evolving site dynamics and the transient nature of construction activities. AI solutions offer the means of overcoming such challenges through the continuous analysis and prediction of data. Organizations are able to go beyond simply analyzing behavior through human eyes by using AI systems for analyzing behavioral patterns as well as environmental factors posing safety threats.

The use of AI technology by companies in Nigeria demonstrates the growing importance of this technology. Ekwueme (2025) reported that engineers working in manufacturing plants in Nigeria are recognizing AI as an effective tool to enhance efficiency and enable sustainable operations. Even though the research was conducted in the manufacturing industry, its results are applicable to the construction industry as well due to the similarities in both.

2.1.3 AI-Driven Surveillance Systems in Construction Safety Management

AI-based surveillance systems integrate various technological elements such as cameras sensors drones, wearable devices, and analytical algorithms. Such systems make it possible for construction companies to carry out 24/7 monitoring and recognize safety hazards more quickly compared to conventional inspection methods. Among the various construction surveillance technologies, AI systems using computer vision are a popular choice. These systems work by examining photos and videos taken from construction sites to identify dangerous situations. Fang et al. (2020) found that deep learning methods could be used for automated safety monitoring by recognizing construction-related hazards visually.

Furthermore the connection between technology adoption and construction projects performance is further stressed by Ekwueme (2026), who has conducted research on cost control, ICT use, and effective delivery of construction projects of school plants in Nigeria. In this way, it is revealed that there is a need to incorporate ICT use in construction projects in order to make them more efficient. AI-powered surveillance can be viewed as a higher level of ICT usage. However, the success of its adoption should be based on the balance between its advantages and ethical concerns. Project procurement and management processes affect the adoption of new technologies in construction projects.

Ekwueme and Madumere (2025) shows through their analysis of contractors' tendering processes that construction project decisions can be enhanced using an analytical approach. The same analytical abilities available in the case of AI surveillance systems can be used to enhance the evaluation and monitoring of contractors. However, construction companies need to make sure that AI does not result in unfair treatment of workers.

Another noteworthy advance is that of wearable technologies. Smart helmets, location tracking technologies, and biometric sensors can give information on the whereabouts of workers, their physiological state, and potential exposure to dangerous working conditions. However, the efficiency of AI surveillance systems depends largely on the data available and accuracy of algorithms used. Inaccuracies in automatic detection of threats could lead to the generation of false alarms or ignoring real threats. Thus, artificial intelligence systems should complement professional safety decisions and not substitute for them.

2.1.4 Ethical Implications of AI Surveillance on Construction Sites

The use of AI surveillance within the construction industry poses ethical dilemmas surrounding privacy, autonomy, equity, and responsibility.

Privacy at work is one of the main issues. While conventional safety checks gather safety-related information, AI surveillance technology can continually gather information on worker behavior, locations, and activities. The issue becomes even more complex when the process of gathering information goes beyond safety purposes.

Information management becomes an important question to answer. It is necessary for the organization to develop policies for gathering, storing, analyzing, and sharing the surveillance information. Workers need to know why the information is gathered.

Algorithmic bias is yet another issue that arises from an ethical perspective. AI systems learn from past data sets, which might be biased and incomplete and affect the performance of these AI systems. With regard to construction sites, faulty data set-based evaluation could negatively stereotype workers as being at risk and lead to uneven surveillance experiences of various groups.

2.2 Empirical Review

This research was carried out by Fang, Ding, Luo, and Love (2023). The title of this study was Artificial Intelligence-Based Computer Vision for Construction Safety Monitoring and Hazard Detection. The methodology applied in this study is a quantitative research methodology that used computer vision and deep learning technology to evaluate the effectiveness of AI monitoring systems in construction projects. The primary data were obtained from the actual video recordings of construction projects while AI was trained to identify unsafe behavior, hazards, and PPE compliance. The results of the research demonstrated that AI-enabled surveillance technologies considerably helped in improving hazard detection, prevented workplace accidents through risk identification at an early stage, increased compliance with the use of personal protective equipment, and improved emergency management by ensuring immediate alerts to site managers. In summary, the study found that AI surveillance systems should be used by construction companies in managing their safety management strategies, ensure proper training of employees, and constantly upgrade the models of AI systems.

This article is entitled Ethical Challenges of Artificial Intelligence Surveillance in Construction Safety Management by Li, Greenwood and Kassem (2022). The methodology adopted was qualitative research based on semi-structured interviews conducted with people working in the field of construction. The participants of the research included construction professionals, safety managers, and experts in technology. Data obtained through the interviews were subjected to thematic analysis. The results showed that the use of AI surveillance poses some serious ethical issues of privacy, security of data, accountability of organizations, informed consent, and the possibility of misusing the surveillance data. Additionally, the results of the study indicated that employees would be more accepting of AI surveillance when organizations put measures of clear data governance and communication of reasons for surveillance in place. This is why it was recommended that construction firms need to develop comprehensive data protection policies, have transparent surveillance measures, adhere to privacy laws, and have accountability mechanisms for decision-making made by AI.

Guo, Zou, and Zhang's (2023) study titled The Impact of Artificial Intelligence Surveillance on Workers' Trust and Safety Culture in Construction Projects. In this research, the researchers used a cross-sectional survey research design to explore the impact of artificial intelligence surveillance on workers' trust towards technology and management as well as the safety culture of the organization. The primary data for the study was collected using structured questionnaires. From the results, it was found that the implementation of AI surveillance in a transparent manner had a positive impact on employees' trust in the use of technology and helped create a safety culture within the organization through adherence to safety protocols. However, from the results of the study, it was observed that inadequate communication on the objective of surveillance had a negative impact on the trust of the management.

3. Methodology

This research will adopt a qualitative case study methodology in order to explore the ethical and safety consequences of the use of artificial intelligence in construction surveillance. Case study methodology is suitable in this context since the AI surveillance is a complex phenomenon involving technological, organizational, social, and regulatory aspects. The study will center around construction organizations that have adopted AI surveillance systems or are contemplating such adoption. Sources of data for the study include academic articles, organizational documents, safety policies, and views of construction professionals.

The gathered data will be analyzed through thematic analysis in order to discern recurrent themes about safety gains, ethics issues, organizational readiness, and governance challenges. This methodology will provide a comprehensive insight into the impact of AI surveillance on construction safety processes taking into account the issue of ethics in adopting technology.

4. Results

The effects of AI-based surveillance systems on the safety performance in the construction industry, focusing on the detection of hazards, accident prevention, proper use of personal protective equipment, and emergency response.

There have been great achievements made in the performance of safety in the construction industry owing to AI-based surveillance systems, which monitor constantly the environment and the activity of people working in it. AI-based computer vision, drones, wearable sensors, and IoT devices are capable of detecting hazardous situations, alerting managers about possible dangers in order to prevent accidents. In contrast to regular safety checks, AI-based safety monitoring is real-time, so it enables quick reaction (Rabbi & Jeelani, 2024). Such techniques can help identify many typical risks on construction sites, such as unauthorized entry into hazardous areas, unsafe scaffolding, machine accidents, falling off high places, and close contact with heavy machines. In addition, using artificial intelligence for surveillance helps meet requirements concerning personal protection equipment because it can recognize whether workers have their hard hats, safety vests, gloves, goggles, and harnesses on. In addition, AI technology is beneficial for emergency responses through real-time location detection, automatic incident detection, and speedy communication to emergency responders, thus reducing response time in the event of an accident. However, research shows that there is need to use AI technology for surveillance in addition to human beings who are experts in safety due to the fact that the interpretation of the situation is very important in the complex construction site environment. Generally, AI surveillance technology increases safety in construction sites (Rabbi & Jeelani, 2024; Sammour et al., 2024).

Table 1: Key Variables for Objective 1

Variable		Dimensions/Indicators		Measurement Indicators
AI-based Surveillance Systems	Independent Variable	Real-time monitoring, Computer vision, Machine learning, Automated alerts		Level of AI surveillance implementation, frequency of monitoring, AI detection capability
	Dependent Variable	Hazard detection, Accident prevention, Proper use of Personal Protective Equipment (PPE), Emergency response		Number of hazards detected, accident/incident rate, PPE compliance rate, emergency response time

ii) The ethical issues of AI-based surveillance in construction, highlighting issues of workers' privacy, security of information, accountability, and proper use of surveillance information.

Although AI-powered surveillance technology is safer compared to traditional surveillance systems, it poses certain ethical dilemmas which need to be regulated properly in the construction sector. The first problem is related to the privacy of the employees as AI surveillance keeps on collecting images, videos, biometrics, and location details from employees during their work shifts. The feeling of being monitored continuously can have adverse implications on the mental state of workers (Liang et al., 2024). Data security is yet another critical ethical matter because surveillance systems will produce significant amounts of data which may become susceptible to cyber-attacks, access without authorization, or any other form of misuse unless adequate cyber-security measures are employed. The problem of accountability arises when the AI systems create false alarms or do not recognize any hazardous conditions. Companies have to come up with guidelines on who is responsible for any decision

by AI systems. Also, the surveillance data collected should only be used for legitimate purposes of improving the safety measures and not for disciplining the workers, assessing their performance, or any other form of discrimination in their employment. Data transparency in terms of how the data is collected, stored, retained, and deleted is very important in order to remain ethical and maintain trust from the workers.

Table 2: Key Variables for Objective 2

Variable		Indicators	Measurement I
AI-based Surveillance Systems	Independent Variable	AI-enabled monitoring, Data collection, Automated analytics, Surveillance technologies	Extent of AI surveillance usage, frequency of data collection, AI monitoring capability
	Dependent Variable		Perceived privacy protection, data security measures, accountability mechanisms, ethical use of surveillance data

iii) The effect of AI-based surveillance on worker trust in technology, trust in organization, and construction organizations' safety culture.

The effect of artificial intelligence-based surveillance on trust in technology, trust in organizations, and safety culture is significant in the construction industry. Workers tend to trust technology when the system of surveillance is capable of accurately detecting any hazards and giving reliable alerts and decisions. Trust in AI-based surveillance improves workers' trust in technology as something that protects them and enhances their work (Chang & Hasanzadeh, 2024). However, repeated false positives, incorrect predictions, or unexplained surveillance processes could diminish trust in the AI system and make workers reluctant to adhere to the system's suggestions. Trust is enhanced within the organization by the clear communication of the purpose of surveillance, the participation of employees in the process of implementing surveillance technologies, and the use of surveillance information for health and safety reasons only. This demonstrates that AI surveillance fosters a proactive safety culture through fostering constant hazard identification, quick reporting and making decisions based on evidence. Employees will be motivated to practice safe working conditions through the assistance of technology, not through its replacement of human judgment. However, excessive surveillance without consultations may lead to fear, opposition and mistrust, thereby damaging organization relations. Therefore, positive safety culture can only be established through balancing the use of technology with employee participation, openness and human surveillance (Chang & Hasanzadeh, 2024; Liang et al., 2024).

Table 3: Key Variables for Objective 2

Variable		Indicators	Measurement I
AI-based Surveillance Systems	Independent Variable	Intelligent monitoring, Predictive analytics, Automated feedback, Real-time surveillance	Level of AI adoption, effectiveness of AI monitoring, frequency of AI-assisted safety interventions
Worker Trust and Organizational Safety Culture	Dependent Variable		Employee confidence in AI systems, trust in management, commitment to safety practices, compliance with safety procedures

4.1. Discussion of Findings

4.1.1 Improvement of Construction Safety Performance through AI Surveillance

The research results show that AI-powered surveillance systems can be effective tools for improving the construction safety management processes by ensuring continuous monitoring and helping to identify risks proactively. In contrast to regular safety inspections carried out at certain intervals, AI-powered solutions operate non-stop and can immediately recognize any risks. One of the benefits that can be cited is the ability to guarantee some safety requirements are fulfilled. Issues typically arise in construction firms when it comes to ensuring that everyone is wearing protective clothing. Using AI-powered computer vision systems helps to solve this problem. This coincides with the research of Zhang et al. (2015) on the use of digital technology in construction safety management, which can be achieved by automatic identification of safety hazards. Similarly, in automated construction safety monitoring, Fang et al. (2020) pointed out that computer vision and deep learning play an important role in the application.

4.1.2 Ethical Issues around Worker Privacy and Data Protection

Even though there are many positive safety aspects of artificial intelligence surveillance systems, privacy becomes one of the key ethical issues. Constant surveillance of construction employees using cameras, sensors, and wearable's may lead people to feel that their personal freedoms are limited. However, when workers are monitored by organizations, it raises a question of a clash between an individual's rights and the needs of the organization. Employers need to make a safe workplace for their employees, but the desire to be safe should not be a pretext to glean any personal data whatsoever. Biometric and location identification become even more complicated due to the need to protect information from any misuse. GDPR has laid down universally accepted principles relating to the protection of personal data like transparency, purpose limitations and accountability. The Nigeria Data Protection Act (NDP Act) provides a framework for data protection in Nigeria, but it is essential that organizations that employ AI surveillance technology be mindful of these principles. This is consistent with the findings of Li, Greenwood and Kassem (2022), Ethical Challenges of Artificial Intelligence Surveillance in Construction Safety Management. The results showed that the use of AI surveillance is ethically problematic in terms of privacy concerns of workers, the security of the data, organization accountability, informed consent, and the potential misuse of surveillance data.

4.1.3 Effect on workers' trust and organisational relationships

The acceptance of AI surveillance systems by workers is crucial for the system's successful implementation (Chukwu et al., 2025; Emeasoba et al., 2026a), and this acceptance is deeply influenced by societal attitudes, workplace norms, and psychological climates. The resistance and lack of cooperation among the employees can significantly affect the efficiency of the workplace (Ezeogidi et al., 2020) if they see AI as an intrusive instrument of control rather than a tool for safety. Perceived usefulness, digital competence, and computer literacy are key factors in successful user adoption as developed from the Technology Acceptance Model (TAM) (Muogbo et al., 2026; Nneka & Okafor, 2013). The adoption of AI within a workforce is more likely when workers have the skill development and technical readiness for the modern workspace to be competitive in the global market (Oguejiofor et al., 2022; Onyiorah, 2025). Moreover, the capability to manage risks effectively and communicate transparently about data handling is crucial for reducing employee anxieties and improving their specialized self-employment or operational efficiency (Emeasoba et al., 2026b; Okoro et al., 2025). In the end, companies should be clear on what information they gather and how they leverage it. Engaging employees in the process builds trust and makes the benefits of the safety solution very real, as well as assuring ongoing operations.

5. Conclusion

AI surveillance is one of the innovations that can positively impact how construction safety management operations are done. These systems have the potential to prevent a large number of accidents by monitoring the situation, analyzing it and detecting hazards. However, the implementation of AI surveillance systems presents numerous ethical issues that should be considered carefully. Issues of organizational trust, biases, data governance, and worker autonomy and privacy can no longer be overlooked. While technology is one part of the equation, proper use is the other part of the equation to the success of using AI to manage construction safety. The implementation of AI in numerous Nigeria-based organizations underlines the spread of awareness of the capability of AI to drive efficiency and performance in organizations. Ethical implications are crucial for construction companies as they strive to meet the safety targets while maintaining the well-being of their employees when implementing AI technologies. The future of AI in building surveillance should be about human-centred innovations.

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