Rapport de veille n° 54

BIM

31/12/2023

Objectif : *L'utilisation du BIM en phase de conception et de ses potentiels applications pour la prévention des risques*

La validation des informations fournies (exactitude, fiabilité, pertinence par rapport aux principes de prévention, etc.) est du ressort des auteurs des articles signalés dans la veille. Les informations ne sont pas le reflet de la position de l'INRS.

Les liens mentionnés dans le bulletin donnent accès aux documents sous réserve d'un abonnement à la ressource.

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1. Références anglophones

1.1 Articles scientifiques

Review of Emerging Technologies for Reducing Ergonomic Hazards in Construction Workplaces
MH Rahman, A Ghasemi, F Dai, JH Ryu - Buildings, 2023, 13(12), 2967
DOI : https://doi.org/10.3390/buildings13122967
In the era of Industry 4.0, marked by the integration of digitization, automation, and data synthesis, emerging technologies play a vital role in mitigating ergonomic hazards within construction work environments. This study investigates the research trends encompassing the adoption of three categories of emerging technologies—(1) wearable sensors; (2) extended reality, which combines virtual reality (VR), augmented reality (AR), and mixed reality (MR); and (3) exoskeletons and robotics—as the means to mitigate the risk of occupational nonfatal injuries in the construction industry. Employing bibliometric and scientometric analyses, a quantitative examination of the relationship in the literature is performed. From the Scopus database, 347 papers were selected from a pool of 1603 publications from 2018 to 2022. The conducted scientometric analyses encompass annual publication trends, keyword co-occurrence analysis, journal-source analysis, author analysis, and country analysis using VOSviewer (version 1.6.19) and bibliometrix software (version 4.1.3). The findings highlight the crucial role of advanced technologies in enhancing safety and health management in the construction industry. Wearable sensors, for example, offer promising capabilities for real-time monitoring, potentially reducing the risk of onsite injuries by alerting workers to hazards. Extended reality, especially VR, can enhance the effectiveness of safety-training education by simulating realistic scenarios while minimizing exposures to hazardous conditions that workers may face onsite challenges. Furthermore, the integration of exoskeletons and robotics has the potential to reduce physical strain and injury risks among workers, particularly in physically demanding tasks. The review paper identifies current research trends in applying emerging technologies to occupational safety and health within the construction industry, while also suggesting future research directions in this dynamic field.

Advancing construction site workforce safety monitoring through BIM and computer vision integration
AS Kulinan, M Park, PPW Aung, G Cha, S Park - Automation in Construction, Volume 158, February 2024
DOI : https://doi.org/10.1016/j.autcon.2023.105227
Ensuring a safe work environment is crucial for construction projects. It is essential that workforce monitoring is both efficient and non-intrusive to the ongoing construction activities. This paper introduces a method that integrates building information modeling (BIM) and computer vision to monitor workforce safety hazards at construction sites in real time. Despite the rising adoption of BIM and computer vision individually within the construction sector, the potential of their integrated application as a cohesive system for workforce safety monitoring remains unexplored. While BIM provides rich 3D semantic information about the construction site, computer vision captures real-time field data. The system was tested using a realistic construction simulation, and the accuracy of the position estimate was evaluated in a real-world interior environment, yielding a mean error distance (MED) of 13.2 cm. Overall, the findings have substantial significance for the construction industry to help minimize accidents and enhance overall worker safety.

Information modeling technologies to ensure industrial safety and reduce the level of injuries in construction

S Shilkina - Construction and Architecture, October 2023, 11(4), pp. 39-39

DOI : 10.29039/2308-0191-2023-11-4-39-39

The construction industry has one of the highest levels of occupational injuries. Despite the fact that most of the incidents occur due to systematic violations of occupational health and safety, many of them could have been prevented by assessing the risks of such traumatic situations at the design stage. Given the multifactorial nature of the building construction process, it is impossible to solve the problem without the use of information modeling technologies — to fundamentally reduce the risk of industrial injuries in the construction industry at the design stage. Currently, BIM technologies have become the most widespread. However, the proposed software solutions do not always include blocks for assessing the consequences of work from the point of view of safety, taking into account occupational injuries when making certain design decisions. This article discusses the issues of occupational safety at construction sites, conducted a statistical analysis of occupational injuries in the construction industry and developed recommendations for the use of modern information modeling technologies to increase the level of personnel protection and assess the risks of traumatic situations at the stages of construction of buildings.

1.2Conférence / ouvrage / thèse

Hazard warning design of intelligent safety helmet based on BIM technology joint positioning

B Wu, Y Yu, W Han, J Wang, G He, Y Shi - Proceedings of the 2023 8th International Conference on Engineering Management (ICEM 2023), 2023

DOI : 10.2991/978-94-6463-308-5_44

Nowadays, construction site engineering safety accidents occur frequently, and there are problems such as unsafe equipment and equipment, management defects, and improper operation of personnel. On the construction site, workers wear safety helmets as required, but fall accidents still occur due to problems such as lack of concentration, irregular construction operations, and unreasonable multi-process three-dimensional cross-operation. with the development of smart construction sites, traditional safety helmets cannot be combined with smart construction site management. Therefore, this paper designs a safety helmet that not only has all the basic functions of traditional safety helmets, but also adds 3D positioning function and safety warning function on this basis. Combine the helmet with the intelligent management platform, use BIM (Building Information Modeling) technology and site CAD planning map technology, and use NDT algorithm preprocess to obtain floor plane information; then improve the Kalman filtering algorithm (ESKF), the positioning information output by helmet-related hardware equipment is secondary processing with Python, the specific plane coordinates and floor height are obtained, and transmitted to Revit software (the most widely used software in China's construction BIM system) for character modeling. Finally, the obtained worker plane position combined with BIM technology is used to obtain three-dimensional location information on the intelligent management platform.