

PC 2. Integrating real-time monitoring technologies with BIM to prevent the risk of falls from height

Filipa Pereira¹, María de las Nieves González García², João Poças Martins¹

¹Construct-Departamento de Engenharia Civil, Faculty of Engineering, University of Porto, Rua Dr. Roberto Frias s/n, 4200-465 Porto, Portugal

²Escuela Técnica Superior de Edificación, Universidad Politécnica de Madrid, Av. Juan de Herrera 6, 28040 Madrid, Spain

Presenting author email: 200200958@up.pt

Abstract

Construction is one of the most dangerous industries, accounting for 22.5% of all fatal work accidents in the EU in 2021 and 18% in the US in 2022. Falls are the leading cause of death, accounting for 35% of fatalities in Korea, 50% in China and 39% in Portugal. Due to the limitations of manual monitoring on complex construction sites, the use of real-time monitoring technologies to track workers and mitigate risks has increased. This study analyses real-time monitoring technologies for fall prevention in construction through a systematic review using the PRISMA methodology, with 39 articles identified as highly relevant. Key monitoring technologies include radio-based technologies such as GPS, Wi-Fi, RFID, BLE and UWB, as well as computer vision using deep learning algorithms [1],[2]. BIM has proven effective in safety planning, enabling early risk identification and mitigation during the design and construction phases. When integrated with real-time monitoring, BIM can alert workers to hazardous areas [3],[4]. Studies on real-time monitoring highlight the challenge of balancing safety with data protection laws, as these technologies often involve the collection of sensitive personal data. While employers have a responsibility to ensure the safety of workers, monitoring must be proportionate and respect privacy rights [5]. Despite privacy concerns, the use of real-time monitoring technologies offers significant benefits, including the ability to identify and address risks before accidents occur. Radio-based and computer vision-based technologies integrated with BIM can improve risk management and have been shown in several studies to have significant potential to improve safety on construction sites.

Acknowledgments

This work was financially supported by Base Funding - UIDB/04708/2020 with DOI 10.54499/UIDB/04708/2020 of the CONSTRUCT - Instituto de I&D em Estruturas e Construções - funded by national funds through the FCT/MCTES (PIDDAC) and by the Doctoral Program on Occupational Safety and Health (DemSSO) of the University of Porto.

References

- [1] S. Chae et al. (2010). "Application of RFID technology to prevention of collision accident with heavy equipment," *Autom. Constr.*, vol. 19, no. 3, pp. 368–374.
- [2] L. Ding et al. (2018). "A deep hybrid learning model to detect unsafe behavior: Integrating convolution neural networks and long short-term memory," *Autom. Constr.*, vol. 86, pp. 118–124.
- [3] M. C. Rey-Merchán (2022). "Improving the prevention of fall from height on construction sites through the combination of technologies," *Int. J. Occup. Saf. Ergon.*, vol. 28, no. 1, pp. 590–599.
- [4] J. Park et al. (2017). "Framework of Automated Construction-Safety Monitoring Using Cloud-Enabled BIM and BLE Mobile Tracking Sensors," *J. Constr. Eng. Manag.*, vol. 143, no. 2, p. 05016019 (12 pp.).
- [5] M. del C. Aguilar del Castillo (2020). "El uso de la inteligencia artificial en la prevención de riesgos laborales," *Revista Internacional y Comparada de Relaciones Laborales y Derecho del Empleo*.