Cybersecurity for Digital Twins in the Built Environment: Research Landscape, Industry Attitudes and Future Direction

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Abstract : Technological advances in the construction sector are helping to make smart cities a reality by means of cyber-physical systems (CPS). CPS integrate information and the physical world through the use of information communication technologies (ICT). An increasingly common goal in the built environment is to integrate building information models (BIM) with the Internet of Things (IoT) and sensor technologies using CPS. Future advances could see the adoption of digital twins, creating new opportunities for CPS using monitoring, simulation, and optimisation technologies. However, researchers often fail to fully consider the security implications. To date, it is not widely possible to assimilate BIM data and cybersecurity concepts, and, therefore, security has thus far been overlooked. This paper reviews the empirical literature concerning IoT applications in the built environment and discusses real-world applications of the IoT intended to enhance construction practices, people's lives and bolster cybersecurity. Specifically, this research addresses two research questions: (a) how suitable are the current IoT and CPS security stacks to address the cybersecurity threats facing digital twins in the context of smart buildings and districts? and (b) what are the current obstacles to tackling cybersecurity threats to the built environment CPS? To answer these questions, this paper reviews the current state-of-the-art research concerning digital twins in the built environment, the IoT, BIM, urban cities, and cybersecurity. The results of these findings of this study confirmed the importance of using digital twins in both IoT and BIM. Also, eight reference zones across Europe have gained special recognition for their contributions to the advancement of IoT science. Therefore, this paper evaluates the use of digital twins in CPS to arrive at recommendations for expanding BIM specifications to facilitate IoT compliance, bolster cybersecurity and integrate digital twin and city standards in the smart cities of the future.

Keywords : BIM, cybersecurity, digital twins, IoT, urban cities
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