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Assessment of the Building Situation Tool Adoption Among Firefighters

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ABSTRACT

Technology is a standard tool that first responders use in their assessment and planning during disasters. Despite the considerable number of hardware and software solutions adopted, first responders still often rely on paper plans when examining indoor disasters. The purpose of this research is to investigate the technical competencies of firefighters and test the building situation tool (BUST) to replace the paper plans. A mixed method approach was used to assess the technology self-efficacy and gather insight into perceived usefulness, ease of use, and the user experience from the firefighters (N=20). The findings show a sufficient level of competency, and that first time users prefer guided instructions, clarity in the user interface, controls, and options to customize the user interface. The findings have practical implications for the future development of BUST and its adoption to the workflow of firefighters.

KEYWORDS

Disaster Management, Indoor Disaster Management, Perceived Ease of Use, Perceived Usefulness, Technology Self-Efficacy, User Experience, Workplace Learning

ASSESSMENT OF THE BUILDING SITUATION TOOL ADOPTION AMONG FIREFIGHTERS

Modern buildings in Finland are equipped with sensors that monitor and manage the comfort and safety of the people inside. Automated heating, ventilation, and air conditioning (HVAC) systems within the buildings optimize the use of resources for indoor space. Sensors throughout the building can monitor temperature, humidity, carbon dioxide levels, smoke, movement, and open or closed doors. This sensor data helps to maintain building temperatures, circulate air, and automatically lock or unlock doors based on preset values and occupancy requirements of the space. The system also monitors for fires, alerting authorities if a fire is detected.

Although buildings are equipped with an array of sensors, first responders continue to rely on paper versions of a building's plans during emergencies (Rescue Act, 2011). These plans are located inside the building. Having access to sensor data allows firefighters to plan their work as they depart to the disaster site.

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To ensure efficiency, first responders (firefighters in the current study) must accept new technologies, be confident in their skills, have support from their workplace, and designate time for learning. The technology acceptance model (TAM) is the most notable method to predict technology acceptance (Davis, 1989). Research with TAM focuses on measuring the user's intention to use technology through constructs like perceived usefulness (PU) and perceived ease of use (PEOU). Its factors measure external variables that influence the intention to use (Venkatesh & Davis, 2000; Venkatesh et al., 2003). Recent research on the technology acceptance of firefighters has modified TAM variables to suit the context of the current study.

Weidinger et al. (2021) examined German firefighters' acceptance of the emergency response information system (ERIS) platform, which gathers, analyzes, and shares information to provide a real-time situational overview of responding units. The study focused on adapting TAM to assess the acceptance of participating firefighters and create a benchmark of ERIS (Weidinger et al., 2021). The model was based on TAM and its extensions, most notably the accuracy, format, and currency of the information provided by ERIS. Although the proposed model suits the current study, it presents similar limitations, including a limited number of potential participants and a homogenous group.

A second study, which focuses on Spanish firefighters, examined the relationship between age, grades, and TAM scores in the context of technology-supported learning (Lluch & Gros, 2018). The findings show no relationship between the variables of age, grades, and TAM scores. The study did, however, find a positive relationship between intention to use, PU, voluntariness, and obtained grades.

Figure 1 shows the Building Situation tool (BUST), developed to trial the use of sensors for the work of firefighters. BUST gathers data from building sensors and presents the status of each room in real time. Yellow or red notifications appear when sensor values rise above a predetermined room temperature value. Yellow notifications represent above-normal values. Red notifications represent extreme values. In addition, the user can toggle through emergency resources inside the building, such as evacuation routes and the location of firefighting equipment or infrastructures.

The authors postulate that the concepts proposed by Haskins et al. (2020) (i.e., teaching general concepts, learning, planned training tasks, suitable trainer capabilities, and the research element) are of significance when enabling learning through other technologies. The firefighters' learning

Figure 1. BUST user interface

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