

Chapter 14

Design and Implementation of PropertySafety: A Wireless Sensor–Based Solution for Safety Management of Vacant Properties

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ABSTRACT

Each year millions of dollars are spent for the prevention of flooding, fire, and burglaries in vacant properties. Keeping a vacant property secure is the most important aspect in preventing damage and one of the most crucial tasks for property owners and facility managers. Building Information Modeling (BIM) is an emerging technology platform that has the potential to be explored in safety-planning solutions for vacant properties. In an attempt to reduce vacant property hazards, this chapter reports upon an integrated system architecture that utilizes BIM and wireless sensor technology to produce a proactive safety and emergency management system entitled PropertySafety. The proposed solution collects real-time temperature, activity, and water detection data remotely; notifies property owners and facility managers through effective visualizations of a building using the BIM platform; and ultimately attempts to contribute in reducing property hazards during the facility management phase of a building lifecycle.

INTRODUCTION

Vacant property can be defined as a property that is unoccupied (Gannon, 2014). Such vacant properties may pose a risk to public safety if constantly neglected by the property owners (Wilkinson, 2011).

In the UK, vacant properties have been repeatedly targeted by vandals and criminals in the last few years. According to an insurance company Aviva, around £2 billion of damage is done to property in the UK through arson and vandalism, 25% of which relates to vacant properties (Cosh, 2012).

DOI: 10.4018/978-1-4666-6623-8.ch014

These statistics highlight that vacant properties can be misused and damaged deliberately if left unattended. Adequate alarm systems and security management solutions can significantly help in damage reduction and prevention in such properties (BSIA, 2013). There are three major threats to vacant properties which are: fire; vandalism/burglary; and bad weather conditions (Halvey, 2001; Willis, 2010; Spelman, 1993). Table 1 illustrates the average number of claims in vacant properties due to these three major threats in 2010 and 2011 in U.S. and UK.

Fire

The most costly and major danger while maintaining a vacant property is fire (Willis, 2010; Willis, 2011). According to US Fire Administration (USFA), 28,000 vacant residential building fires were reported to US fire departments from 2006 to 2008 which caused 45 deaths, 225 serious injuries and \$900 million in property loss (FEMA, 2011). Moreover according to Fire Protection Association UK, nearly 9,000 fires are attended by fire fighters in vacant buildings each year in the UK (Willis, 2011). Vacant buildings are attractive targets because such facilities are usually easier to enter (FEMA, 2011). Similarly, another danger arises when vacant facilities are used for storage of flammable materials which pose serious fire threats to close by structures and buildings (Willis, 2010).

Vandalism and Burglary

Other major threats to vacant properties include vandalism and burglary. Vandalized property may cost huge amount of money to property owners when restoring the buildings (FEMA, 2011). Burglaries and thefts also contribute large costs to building owners. It has been observed in the US that almost 90% of burglary in vacant properties usually involves plumbing or copper electrical materials (Phillips, 2011; Bauroth and Gilbreath, 2009). Whereas in the UK, over 1,000 metal thefts occur every week from vacant buildings according to the Vacant Property Specialists (VPS), who are responsible for managing around 90,000 vacant properties in the UK (VPS, 2013).

Weather

Weather poses a threat of significant damage to vacant properties and can cost thousands of dollar to repair as well as potentially delaying new occupants from moving in (VPS, 2011). Adverse weather conditions may cause water pipes breakage in facilities and consequent water leakage (VPS, 2013). In addition, rainwater entering in the facilities can also extensively damage the structure and its contents (FEMA, 2005). The objectives of this work are: (1) to review current research on integrated solutions based on Building Information Modeling (BIM) and wireless sensor technology; (2) to present BIM based system

Table 1. Average number of claims in vacant properties due to major threats

	Fire (%)	Vandalism and Burglary (%)	Bad Weather (%)	Reference
US	48	20	31	(Willis, 2010)
UK	1.8	40	40	(Willis, 2011)

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