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KNX building automations interaction with City Resources Management System

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Abstract

Many buildings have been equipped with Building Automation Systems for resources consumption management. The next step is interconnecting those buildings in a City Resource Management System with the power plants, gas plants, water treatment plants, waste water plants and all the other community plants. This paper proposes a solution by avoiding building automation security leaks based on KNX technology and routing servers.

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1. Introduction

Along with the development of the society and rising of living standards, the automation systems are present in every aspect of our lives including our buildings. There are two categories of building automation systems, with the same main functions but different scales, developed for comfort and resources management: Home Automation System (HAS) and Building Automation System (BAS). The next logical step is to develop a resources management system on a city scale. The integration of all buildings in a City Resources Management System (CRMS) can be possible by using building automation standards in implementation for the system to be uniform.

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The resources consumption rise every year and the CRMS is a current need of our days. CRMS is a grid that can provide resources by request and give commands and instructions to the consumer buildings. Companies in the field of building automation and power grids have started to exploit the concept of automations for all types of resources management in a city and an example is the KNX City [1] developed by the KNX Association. The result will be that all the buildings from a city will be interconnected for a better resources management with the power plants, gas plants, water treatment plants and for tailings management with waste water plants, waste processing plants and all the other community plants. An example is that the power plant can announce the city to reduce the energy with a specific percent if is in impossibility of supplying, fact that will reduce the number of power failures in the electricity network. Also the building can demand a specific power at a specific time and with the BAS energy management algorithms the power peaks will be completely avoided. Another example is the using of pressure sensors under trash containers. Only at a specific weight a truck will come to take content.

Different methods of data collecting from KNX networks into databases are presented in [2]. In [3] are developed procedures and methodologies for the design of a KNX device node. In [4] is described the design of a KNX automation system dedicated for ensuring the comfort into an office/classroom space. Using a server and a touch panel in a KNX network is demonstrated in [5].

2. Building automation system implementation

The basic principle in a BAS implementation is by automating every single system or managing every resource consumer from that building [6]. The basic elements in implementing a BAS are sensors and actuators, all as BUS devices and all with their own controller for taking decisions. The HMI (human-machine-interface), that is usually a touch panel or a smart phone, is the device from where the building owner set the parameters that will rule the automation system.

KNX is a global standard and technology for building automation and is owned by the KNX Association. The available KNX devices ready be used in a BAS are presented below for every system:

- Lighting – lighting controllers with predefined scenarios and learning functions;
- Heating/cooling, ventilation and air conditioning (HVAC) – equipment dedicated for every type of thermal execution element: digital thermostats, radiators valves controllers, ventilation unit's controllers, ventilation plant's controllers;
- Energy management system – digital counters for water, gas, electrical energy;
- Security system – equipment for interconnection with different burglary stations;
- Access control – locks, keyboards, RFID, fingerprints in conjunction with the intercom;
- Video-surveillance system – video camera controllers and adapters with alarms feedback in conjunction with the security system and the intercom;
- Fire detection system – fire detectors adapters;
- Public address – amplifiers and devices for audio system volume, zone and alarms control;
- Intercom communications system – intercom adapters with functions as doors control, doors state.
- Window blinds control – blind actuators for controlling the positioning motors;
- Elevators monitor – modules for elevators parameters and alarms monitoring;
- Weather station – with temperature, wind, humidity and rain sensors;
- Water supply system – controllers for managing the water circuits and water tanks in conjunction with irrigation;
- Irrigation (inside and outside) – modules for logical functions implementation considering information from ground humidity sensors and weather station for irrigation control;
- Multimedia entertainment control system – converters for KNX interfacing;
- De-icing system – controllers for gutters, stairs, alleys and space in front of garages electric heaters with information received from ground frost sensors;
- Doors/gates – devices for doors/gates control and monitor.

The additional elements in a KNX BAS, besides the KNX Sensors and KNX Actuators are the KNX Power Supplies, KNX Line Couplers and KNX IP Routers. Every line from a KNX BUS must be powered and the number of devices from that line is dictated by the supply current (every KNX device consumes 10mA from the BUS, so with a power supply of 640mA we can power maximum 64 KNX devices). The main KNX line must be also

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