SIEMENS

Building Technologies Division   Zug, September 16, 2014

Ready for any emergency:
Planning for safe building evacuation

By Markus Niederberger, Business Development Manager, Building Technologies Division, Siemens

Researchers and building technology experts at Siemens are working together to develop solutions that allow buildings to be evacuated safely and efficiently. They have developed complex simulation technologies that proactively detect where hazardous situations can occur during building evacuation. Siemens now offers building operators a service that analyzes their properties. Using this knowledge they can initiate corrective actions in a timely manner. What's more, by coupling building automation and safety and security systems, it will be possible to intervene during evacuations to control the required measures, for example in case of fire.

In a fire or other hazardous situation, airports, train stations, office towers and large hotels need to be evacuated quickly and safely. But how can this be managed in an emergency? And how can large properties be evacuated systematically and in an orderly manner to proactively prevent panic situations?

One prerequisite is the ability to reliably predict the expected crowd movements – a complex task. To this end Siemens has developed simulation software that forecasts the movement of flows of people and test evacuation scenarios. Where and when can critical situations be anticipated during an evacuation? The objective is to ensure these situations never even occur, and to reduce the evacuation time required.

Ten times faster than in real time

An innovative calculation method forms the basis for the new Crowd Control simulation software developed by Siemens Corporate Technology (CT). Analyzing

every person and all their interactions with others would quickly exhaust computing capacities. Instead, Siemens researchers rely on an aggregating process. Rooms are divided into individual cells equal to the space occupied by one person. The behavior of empty and occupied cells is defined using force fields. Exits and destinations can be added, as well as obstacles such as parked cars or fire. In terms of effect, objects are valued differently from people, and individual behavior is differentiated from group behavior.

The Siemens model can thus simulate how groups of hundreds, thousands, or tens of thousands of people behave – at a rate ten times faster than their speed of movement in real time. Linked with real information from surveillance cameras, the Crowd Control software can predict crowd movements up to five minutes in advance. This allows response teams to gain valuable time and mitigate critical situations through targeted intervention.

Crowd Control makes new buildings safer…
But the new software not only helps prevent escalation right before a potential disaster. As an analysis and planning tool, it enables architects to develop safer designs for buildings with high foot traffic.

The Siemens Building Technologies Division offers evacuation simulation as an end-to-end consulting service. The service includes the full spectrum of analysis, from data collection and preparation, to the generation of reports, to the interpretation of results.

Based on CAD data of the building structure, the software automatically generates a 3D model. Other elements such as gathering points, defined routes and doors with one-way access complete the data model. The next step is to add individual persons and groups and how they typically gather and move in buildings and to simulate the evacuation process. The software calculates and visualizes the possible evacuation routes as well as the expected volume of people in 2D or 3D. It even takes into account that some individuals will move counter to the flow of the evacuating crowd, such as first responders who need to get to the source of a fire.

Points prone to dangerous situations can be identified right during the planning process for a building. These bottlenecks can then be alleviated through appropriate construction measures.

...and optimizes existing buildings and systems
Crowd Control can also be useful when refurbishing or repurposing a building. Building operators often ask themselves how pending renovations or scheduled events will impact the evacuation scenario. The new consulting service from Siemens can quickly identify whether existing rooms and escape routes meet requirements, such as those prescribed by law. Crowd Control is also able to simulate the effect of obstacles on the evacuation. The program automatically takes into account what alternative routes are available if a particular escape route is suddenly blocked.

The following example illustrates such a scenario. One of the three stairwells in an office building is temporarily locked and cannot be used as an escape route. The simulation shows that as a result evacuation would take three times longer. Not only because the total route is longer, but also because the capacity of the remaining stairwells is barely adequate to accommodate the larger number of people, which in turn causes massive delays.

In addition, the knowledge gained from the simulation can be used to optimize existing safety and security systems. Based on the simulation results, a voice alarm system can issue predefined announcements and indicate the best escape route for the situation.

Virtual training for first responders
In addition to its usefulness as an analysis and planning tool, Crowd Control is also a good training tool. It is true that safety and security officers, evacuation aides and floor managers are trained for emergencies. However, a "real" building evacuation is a very stressful situation, especially if bottlenecks occur or blocked stairwells need to be dealt with.

There are also environments in which emergency training cannot generally be performed because the buildings are never without foot traffic. Airport terminals are a prime example. For such environments Crowd Control is a useful tool to virtually

train evacuation aides because the software can be used to generate training videos**.**

Different Siemens buildings in Germany have already been evaluated using the Crowd Control tool. Initial customer projects are currently in the planning phase. In general, the building evacuation consulting service from Building Technologies is particular useful for companies that manage buildings with hundreds of employees or that lease their properties to third parties.

Dynamic evacuation in case of fire
Siemens plans to integrate Crowd Control into the building automation systems from Building Technologies. This will allow the evacuation process to be managed by proactively controlling the escape routes in a building. Siemens experts are currently working on such dynamic fire safety solutions – intelligent response systems that respond to hazardous situations dynamically and can guide persons away from the danger.

These solutions emerged from the often inadequate directives for building evacuation. "If panic breaks out, the nearest exit is not so easy to find," says Christian Frey, innovation expert at the international headquarters of Siemens Building Technologies Division in Zug. Intelligent information technology can lend assistance here, such as through mass text messages (SMS) or voice alarms, warnings on the computer screens of employees, messages on large digital screens in stairwells and corridors, or arrows on smartphones that point to the shortest and safest escape route. Siemens has already deployed its mass notification solution in the USA and will be introducing it in Europe shortly.

At the same time, sensors record the flows of people in this scenario. "This allows intelligent building systems to detect early on if a specific escape route is at risk of overload. People are then directed to alternative escape routes so they can exit the building quickly and safely," explains Frey.

Forecasting using virtual fires
In the future, building management systems could even be linked directly to the fire department's computer system. Rescue personnel would then receive a digital facility map that not only identifies the source of a fire but also the direction in which

it is spreading. Simulation experts at Siemens CT have already developed a method to precalculate the spread of a fire in different types of buildings. They set a "virtual fire" to study the different effects on various environments, building types and equipment. Are the rooms empty or furnished? Do they contain highly flammable or fire-resistant materials? What are the walls and floors made of? Where is the wiring? This information can be used to accurately predict the spread of a fire – an invaluable tool for any crisis response team to take the necessary steps quickly and effectively. Beyond that, Siemens experts want to go even further by developing simulations for floods, explosions, earthquakes and storms.

Contact for journalists:

Catharina Bujnoch, phone: +41 41 724-5677

E-mail: catharina.bujnoch@siemens.com

A **press picture** is available at

http://www.buildingtechnologies.siemens.com/download-center/Download.aspx?pos=download&fct=getasset&id1=PR00331&filename=\Pictures Crowd Control.zip

Follow us on Twitter at: www.twitter.com/siemens_press

The **Siemens Infrastructure & Cities Sector** (Munich, Germany), with approximately 90,000 employees, focuses on sustainable and intelligent infrastructure technologies. Its offering includes products, systems and solutions for intelligent traffic management, rail-bound transportation, smart grids, power distribution, energy efficient buildings, and safety and security. The Sector comprises the divisions Building Technologies, Low and Medium Voltage, Mobility and Logistics, Rail Systems and Smart Grid. For more information visit www.siemens.com/infrastructure-cities

The **Siemens Building Technologies Division** (Zug, Switzerland) is the world leader in the market for safe and secure, energy-efficient and environment-friendly buildings and infrastructures. As technology partner, service provider, system integrator and product vendor, Building Technologies has offerings for safety and security as well as building automation, heating, ventilation and air conditioning (HVAC) and energy management. With around 28,000 employees worldwide, Building Technologies generated revenue of approx. 5.8 billion Euro. For more information, visit www.siemens.com/buildingtechnologies