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Achieving Energy Efficiency with “Local Warming”

MIT researchers develop a system that creates personalized climates around individuals – an alternative to heating entire buildings.

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Vicki Ekstrom, MIT Energy Initiative

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*"Local Warming" exhibit at the 14th Venice Architecture Biennale.
Photo: Giulia Bruno, Laura Fiorio, Christopher Green, Miriam Roure
and the Senseable City Lab*

MIT researchers have developed a system that creates personalized climates around individuals. The project, called “Local Warming,” uses WiFi-based motion tracking and ceiling-mounted dynamic heating elements to target a single person and create a precise personal climate around occupants of a building. As a result, each person is kept comfortable while the space around them is maintained at a lower temperature – saving energy. The “Local Warming” technology made its debut at a biannual architectural festival that opened on June 7, 2014, the [14th Venice Architecture Biennale](#).

"Today, a huge amount of energy is wasted on heating empty offices, homes, and partially occupied buildings," says Professor Carlo Ratti, director of the MIT Senseable City Lab, which led the project. "The technologies underlying Local Warming could address this by synchronizing climate control with human presence, vastly improving the energy efficiency of buildings."

As a visitor enters a room, the person’s location and trajectory are spotted using a new WiFi-based location tracking technology developed by Professor Dina Katabi and her team in the MIT Center for Wireless Networks and Mobile Computing, housed in MIT’s Computer Science and Artificial Intelligence Laboratory. This information is then transmitted in real time to an array of dynamic heating elements positioned in a grid near the ceiling. Each element is composed of a servo-motor that changes direction, a bulb to generate infrared radiation, a cold mirror and other optics to create focused beams.

"Infrared heat is emitted to generate what are essentially spotlights of warmth centered on people a few meters away," explains Leigh Christie, the project engineer. "This ensures ultimate comfort, while improving the overall energy efficiency."

Miriam Roure, the lead researcher on the project and a research fellow in the Senseable City Lab, noted that the first commercial application of this technology might be responsive outdoor heaters that warm people as they move through exterior or semi-covered spaces. Local Warming systems could then be installed in large lobbies or industrial lofts – spaces that are often sparsely occupied. As the technology further develops, it could allow each person to define the specific temperature they prefer via smartphone.

"With a dynamic system like Local Warming in place, buildings may not need to waste as many resources on climate control," says Roure. "Local Warming allows participants to engage with their climate directly and to enact a new type of efficient, localized climate control."

Local Warming is a main component of the Central Pavilion at the Venice Architecture Biennale, which runs from June 7 to November 23, 2014. The theme of this year’s festival is on “Fundamentals” – core elements of architecture and their progression through history. Fittingly, Local Warming is installed in a room focused on the “Fireplace.”

“The earliest heating technology was the fire pit, a fixed domestic element that people gathered around. Since then, climate control has been unmoored, with the development of pipes and thermostats. But today, man no longer needs to seek heat – heat can seek man,” says Matthew Claudel, also a fellow in the Senseable City Lab and the project curator. “Local Warming is a new approach in the broader history of climate systems.”

This research is sponsored by the MIT Energy Initiative (initially through a [seed grant](#)) and the energy utility company ENEL.

ABOUT THE SENSEABLE CITY LAB

The MIT Senseable City Lab is a multidisciplinary research group that studies the interface between cities, people and technology. It brings together designers, planners, engineers, physicists, biologists, mathematicians, as well as social, computer, systems and data scientists. The Lab collaborates with industry partners and metropolitan governments on a broad spectrum of projects, aiming to open new possibilities for citizens and new opportunities for urban communities around the world. More: <http://senseable.mit.edu/>

The MIT Energy Initiative (MITEI) links science, innovation and policy to transform the world's energy systems.



Infrared light beams follow occupants, creating personal climates. Photo: Aaron Nevin

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