Informative Smart Green Office Buildings

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Abstract  Calling for the development of office building information systems and devices that inform and inspire workers and visitors.

Keywords  Sustainability · Energy · Architecture

1 Background

Architects are further along than most in pursuing and adopting sustainable, environmental solutions. In the United States, the LEED standard for Green buildings was instituted in 2000. That same year, the Conde Nast building was erected in New York City and became the first to be certified with the LEED standard. Since then, hundreds of buildings have been certified most of them office buildings. These buildings include features such as efficient heating and cooling systems, self-adjusting CO2 vents and air quality monitors, greywater recycling programs, and green roofs. However, walking into these spaces, one would never know that they have been built and continue to be maintained based on progressive green standards. This is a big missed opportunity.

Instead of simply constructing green buildings, practicing sustainability should be a continuously evolving process which invites interaction and change over time. A building that does not consciously communicate its green intentions to its occupants allows the occupants to remain tremendously wasteful (or passive and unconscious). A green building should be a powerful tool to effect change.

The hundreds of thousands of people who enter these buildings every day could be informed about the issues that the architects sought to address when making construction decisions. A person will be more likely to change their own habits at home if they see how measures in their workplace drastically reduce energy usage or water consumption. A compelling presentation of information from the buildings sustainability systems will show that green measures are dynamic and modern, as opposed to burdensome.

To give a sense of how this might play out, consider this scenario:

Eric goes to his office in midtown New York on a hot summer day. As he enters through the revolving doors, a number on the wall tells him how much energy the revolving motion of the doors has generated. On the floor of the lobby is a projection of the roof garden that is 30 floors above, and the glowing lights along the ceiling indicate that the sunny day translates to a big energy boost for the buildings solar panels much more than the day before. Eric gets on the elevator. As he rides, he hears the sounds of the birds on the roof garden. As the floors pass, a monitor displays the air quality in each of them. Eric notes that the fourth floor seems to have consistently more oxygen-rich air than the others, and he decides to find out why. As he arrives at his floor, he notices with dismay that there are still trace levels of formaldehyde in the air. He resolves to talk to the office manager about this.

Eric arrives at his desk. His lights turn on automatically and vents open on the wall to release more oxygen into the space. Noticing again that he likes the quality of light that the energy-efficient bulbs emit, he decides to purchase some for home. Eric is feeling great, but a little chilly; the office manager tends to keep the floor cooler than he prefers. He decides to turn on the small heating unit above his desk. When he turns his computer on, the initial screen lets him know that the heater will bring his personal energy usage above his goal for the day. Eric has been involved in a rivalry with Bob from sales for the lowest energy usage of the month. Instead of turning off lights to even out his usage, he checks some numbers and finds that the office manager could turn the fan on above her desk it would use just 15 percent of the energy of his heater. Eric goes and talks to her. She agrees to use her fan and he proceeds with his workday.

During his lunch break, Eric eats some of the food from the company share of the community-supported agri-
culture program. He knows from the Green Building Desktop widget on his computer that his tomatoes come from a family farm 43 miles from the city. He looks at the farms Web site and decides to buy a share of produce for his home. Also through the widget, he checks on the live video feed from the roof garden. The water meter sculpture informs him that yesterday's two inches of rainfall translates into 100 gallons of water diverted from sewer overflow to be used by the garden and in the buildings greywater system.

At the end of the day, Eric descends in the elevator and walks through the lobby. Often he is tired upon leaving work, and the light displays in the lobby seem to him just some interesting calming lights on his way out the door. Today he has some extra time, so he lingers at the interactive display, which provides more information about the data projections. The display shows that the entire building is using just 48 percent of the energy that a comparable non-green building would use.

The scenario described above touches on many aspects of green buildings and how information about them can be used to help inspire further environmentally friendly behavior. Four areas of potential research are devices, data, design and people.

2 Devices: Specific technologies to be researched and developed.

There is a need for smart sensor networks that provide data to describe a variety of locations: the entire building, a specific floor, a specific department, personal workspaces, and the roving personal spaces that people use as they move through an office building. More sophisticated air quality sensors are necessary, as well as small mobile devices and hardware that is easily maintained by office workers using DIY techniques.

Hardware and software solutions should have the ability to intelligently monitor change over time. For example, a system should sense the time of day and number of people in the building plus the temperature and smog levels outside before adjusting the temperature. The integrated systems currently being developed for Smart Homes should be used in multi-use office buildings. An adaptable system could also measure the level of commitment to green practices of its users and then adjust goals and encourage greater interactivity.

3 Data: Translate sustainable building elements into evolving feedback mechanisms.

- Heating and cooling - air temperature should not simply be adjusted, but should remind people that there are alternatives to traditional fossil fuel-burning systems such as smart ventilation and passive solar technology.

- Non-toxic materials and cleaning supplies should not be hidden, but instead made automatically available to employees for their homes.

- Energy usage data should be gathered on a building, floor and personal level, and can be compared to other buildings, periods of time or imagined scenarios. Users should understand how much energy solar panels save and how much air conditioners use without having to translate spreadsheets of information.

- Recycling of electronics, paper and other products should be tracked and goals set continuously to improve practices building-wide.

4 Design

- Information about air quality and resource usage should be as ubiquitous as the symbols used in weather reports. Iconography should be developed that spans buildings and continents; a visitor to a building in Dubai will immediately understand the quality of life within a given space, because of the icons used at his New York office.

- A variety of levels of information design can provide satisfying experiences to different types of users. Visitors should understand simple elements of the building design such as green roof and alternative energy features, while workers in the building should have access to more in-depth personalized information displays while not being overwhelmed with data. Interfaces to the information can include rich desktop and mobile-phone applications, immersive audio, video or lighting, and interactive kiosks and panel displays. Users should have an opportunity to receive immediate feedback on their behavior.

5 People: To encourage action, information must be convenient and compelling.

- Tips about how to continue green practices at home should be provided to users of the building.

- Playful interaction can express energy usage. A hand pump in a kitchen or a stationary bicycle in the building gym could power a stereo.

- The system can utilize social networking as a tool to encourage change by allowing users to compare and share personal data.

- These information systems can be made to be empowering allowing workers to take control of the spaces in which they spend so much time.

- The emotions of the users should be studied. Too often sustainable practices are thought about in terms of personal responsibility, which creates a sense of guilt and burden. A smart building can encourage a sense of community and progress.
6 Conclusion

Research also needs to be done on costs, and ways to create systems for businesses that are not able to build or renovate entire buildings. Factory spaces should be considered. Opportunities exist for the creation of personal devices which monitor air quality and energy usage. These can be used by people who do not work in green office buildings and can provide compelling feedback and be used to empower people and start conversations about sustainability.

This short paper is intended as an overview of possible areas of study into creating better, more informative smart green office buildings. My interest in the topic is borne from a passion for sustainability and the ongoing desire to inform more people about positive change and possibility. As an interaction and graphic designer, I see tremendous possibilities for creating interfaces that provide users a chance to understand the spaces they live in and the ongoing relationships between people and their ecosystems, both natural and manmade.

7 Author Biography

Rebecca Bray is a designer and consultant working with nonprofit organizations to develop interaction design and sustainability practices. She is currently the Sustainability Facilitator at Eyebeam Art and Technology Center in New York City where she helps curate public programming and coordinate artists and staff in greening both the artistic process and the building.

She produced the Webby Award-winning Web site for the most popular environmental advocacy film online, The Meatrix. She has served as Art Director at Sustainable Table and the Eat Well Guide.

Rebecca has created gardens in New York City behind cafes and on rooftops, and was recently part of the team that created Botanicalls (www.botanicalls.com), a system that allows indoor plants to use telephones to call their owners with requests for water. She is also one of the developers of an upcoming Web site that uses participatory Web 2.0 principles to create new markets for environmentally friendly products. The sites business plan was runner-up in the 2007 NYU Stern School of Business Social Entrepreneurship competition.

Rebecca has consulted with and created pieces for various institutions and nonprofit organizations such as the Audubon Society of New York and the Smithsonian National Museum of Natural History. She is currently designing an installation for the American Museum of Natural Historys upcoming water exhibit.

A graduate of the Interactive Telecommunications Program at NYU, her recent thesis a plan for an educational center about plants called Plantopia examined new possibilities for interaction design and technology in museums.