A Living Laboratory at Rutgers

Environment, Design and User Behavior

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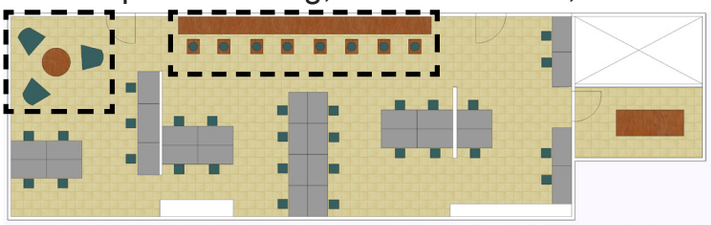
What is a Living Lab?

A user-centered, innovative test-bed that allows exploring ideas and concepts in real-life cases.

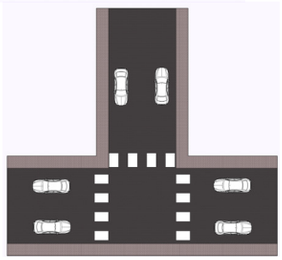
- **Users** experience & design their future in parallel
- **Researchers** test ideas in real settings and evaluate impacts before implementing them at scale

Living Lab Locations

- **Indoors**: Computer laboratory of Bloustein School Civic Square Building, New Brunswick, NJ



- **Outdoors**:
Somerset St & College Ave intersection, New Brunswick, NJ



Data Collection and Methods

Objective Data

Through sensors installed in the living lab locations

- On environmental conditions

Temperature-Humidity-Noise-Lighting-Air Quality

- On user presence

People counters-Occupancy sensors-Placemeters

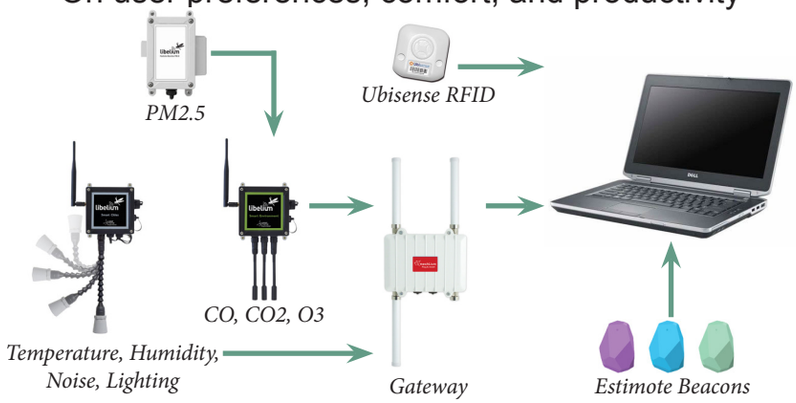
- On user activities

Ubisense RFID tags-Estimote Beacons

Subjective Data

Through short longitudinal surveys of living lab users

- On user preferences, comfort, and productivity

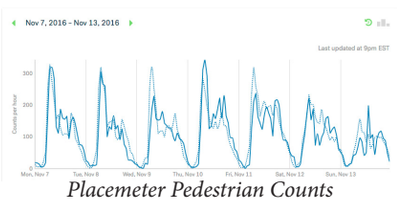


Objectives

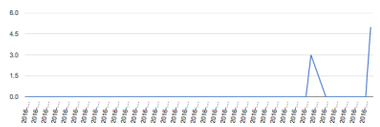
- Engage faculty and students in learning and research on environmental conditions, physical design and occupant/user behavior
- Optimize energy efficiency performance and urban design for effective long-term climate change adaptation
- Suggest sustainable platforms, through conducting true experiments and enriching existing simulation models

Preliminary Results and Analysis

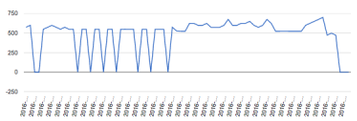
Environmental conditions, occupant presence and activities are reported to a dashboard real-time.



Placemeter Pedestrian Counts



PM2.5 in µg



Carbon Dioxide in ppm

The dashboard website is currently developed to eventually provide analytics of all sensors data that is stored in a centralized database system.

The resulting datasets will later incorporate coded responses from the longitudinal surveys.

- **Multivariate regression analysis** will unfold statistically significant influences among the variables of interest.
- **Path analysis** will generate a values-based framework to predict surveyed behaviors and help understand the form of functions derived.

Selected References

1. ANSI/ASHRAE Standard 55-2004: Thermal Environmental Conditions for Human Occupancy. Atlanta, GA. ISSN 1041-2336.
2. de Dear, R.J., and G.S. Brager, 1998. Towards an adaptive model of thermal comfort and preference. ASHRAE Transactions, Vol 104 (1), pp. 145-167.
3. Clinton Andrews, Daniel Yi, Uta Krogmann, Jennifer Senick and Richard Wener, "Designing buildings for real occupants: An agent-based approach," IEEE Transactions on Systems Man and Cybernetics A: Systems and Humans 41(6) (November 2011): 1077-1091
4. OSHA Standard 1910.1000: "OSHA Policy on Indoor Air Quality: Office Temperature/Humidity and Environmental Tobacco Smoke." Feb. 2003.