

UBC

Smart City

Annual Report

May 2022



UBC Smart City
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smartcity.ubc.ca

Foreword

[UBC Smart City](#) is an interdisciplinary engineering design team working to create new innovative solutions for our cities. We bring together people with a passion for technology and the built environment, giving students the opportunity to develop varied technical skills and a critical problem-solving mindset.

At the beginning of this year, our second year in existence, we received approval to operate as an official engineering design team at UBC. This was followed with an overwhelming number of applications to join the team during our September recruitment period. With such a high level of student interest, we were able to select outstanding students from several engineering disciplines to join our team. It is clear that students are craving opportunities to work on disruptive projects and help create better cities.

The diverse technical backgrounds of our members has made it possible for to take on bigger projects and increase our impact. In October 2021, we presented our proposal for the ASCE Blue Sky Innovation Contest, winning first place at the National ASCE Convention. We also took on three self-guided projects, including one collaborative project with Third Quadrant Design, another civil engineering design team at UBC. In addition, we continued to grow our network in the industry and at UBC to support our team's future success.

This report showcases our accomplishments over the past year and provides a roadmap for our future. Thank you to our supporters, community partners, and our talented team members for all your contributions to the team this year.

- Benjamin Corbett

Team Captain, 2021-2022





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Sponsors

UBC Smart City would like to extend a sincere thank you to our sponsors for their generous donations to our team. Our sponsors help fund contest registration fees, software licenses, honorariums for guest speakers, and banners/merchandise which is used to advertise for our team and attract talent.

Thanks to our sponsors, we train and inspire new leaders to make our cities more sustainable, innovative, and resilient.



THANK YOU!
To our Gold sponsors!

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ENGINEERS &
GEOSCIENTISTS
BRITISH COLUMBIA





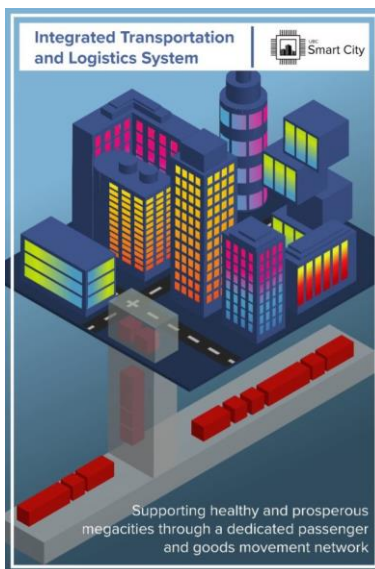
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Competitions

ASCE Blue Sky Innovation Contest

What will our cities' infrastructure needs look like in 2040, 2050, or even 2070, and how can we start preparing today? Our proposal, the Integrated Transportation and Logistics System, or ITLS, meets this challenge by providing fast and efficient people and goods movement across a polycentric megacity of 50 million people. By removing congestion from streets, the ITLS will help create high-quality public spaces and increase cities' quality of life. Our solution outperformed its competitors in the Rocky Mountain Student Conference in April 2021, and the National ASCE Convention in October 2021, to secure first place.

How would the ITLS work, and how could it benefit your city? Read our [proposal](#) to learn more!



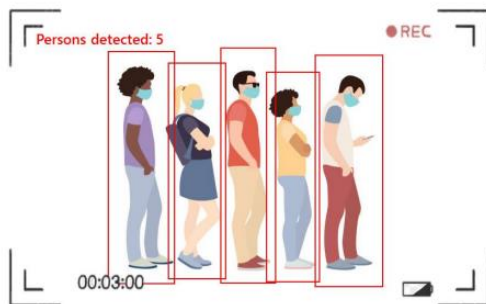
UBC Smart City – first place winners at the 2021 National ASCE Blue Sky Innovation Contest!



Projects

Transportation Project – Automated Queue Counting

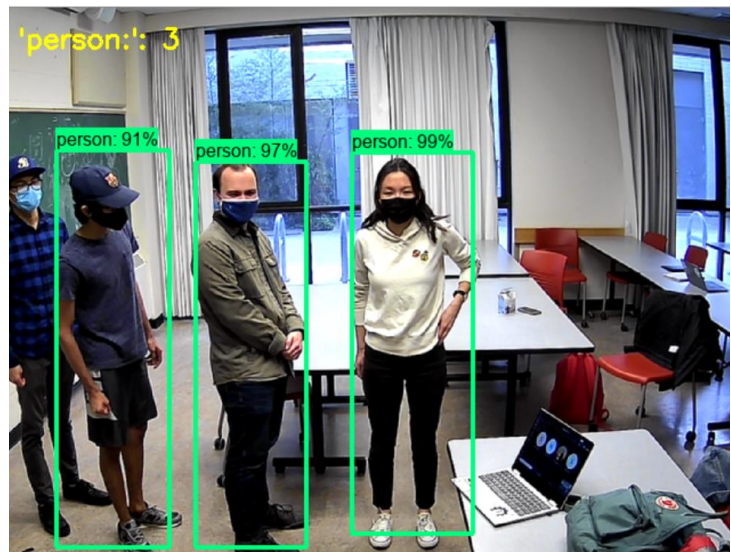
UBC Smart City worked on developing an automated technology to count the number of people in a queue applied in a transit context. By combining live video streams or images with machine learning, this **privacy-centered** technology aims to provide immediate, **anonymized** wait time and crowding data to customers and organizations. This software component consists of an object detection and tracking model. The team integrated this software with the necessary hardware: a camera attached to a single board computer. If successfully implemented, the queue counting system would facilitate transit planning, increase travel equity, improve the customer experience, and reduce personal vehicle use resulting in many economic and environmental benefits. We envision that the collected information will provide a myriad of opportunities to improve the transit user experience at UBC including integration with TransLink’s LCD dynamic digital screens, creating a “Floating Bus” that reacts with demand, and optimizing person-delay with signal pre-emption with wide-scale implementation.



Input



Output



Model Testing Results on Smart City Team Members

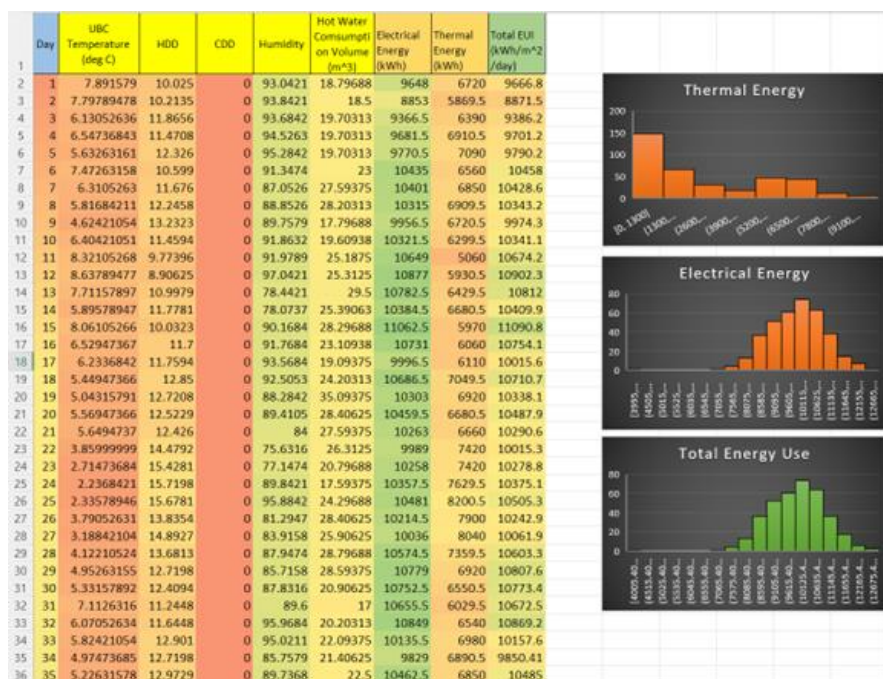


Energy Project – Building Energy Modelling

Building maintenance and operation have historically accounted for 97% of the total greenhouse gas emissions on UBC. The Climate Action Plan 2030 (CAP 2030) addresses this issue by targeting a near zero operational emissions for existing buildings. UBC Smart City has taken a bold initiative to construct a multiple linear regression model to examine the predictors of current energy use intensity (EUI).

Our team selected the buildings in the Chemistry Complex as our focal point due to their location, functionality, and similar structural features. We chose 2021 as our base year to analyze the most recent annual datasets. We obtained building utility data from UBC SkySpark. This includes electrical and thermal energy use, building envelope and architectural drawings from the Building Infrastructure Department, as well as meteorological data, including heating and cooling degree days and daily average temperatures.

This combination of data across seven buildings allowed us to achieve a large sample size for analysis. By comparing the results for each building, we can test the robustness of our model. The results of the project will be presented in a Tableau dashboard, illustrating the fundamental relationship between energy consumption levels and the predictor variables we identified. We aim to increase the scale of our model to facilitate all buildings on campus and to tailor it for UBC SkySpark datasets for seamless data acquisition and analysis in real time, minimizing time and costs associated with strategic planning.





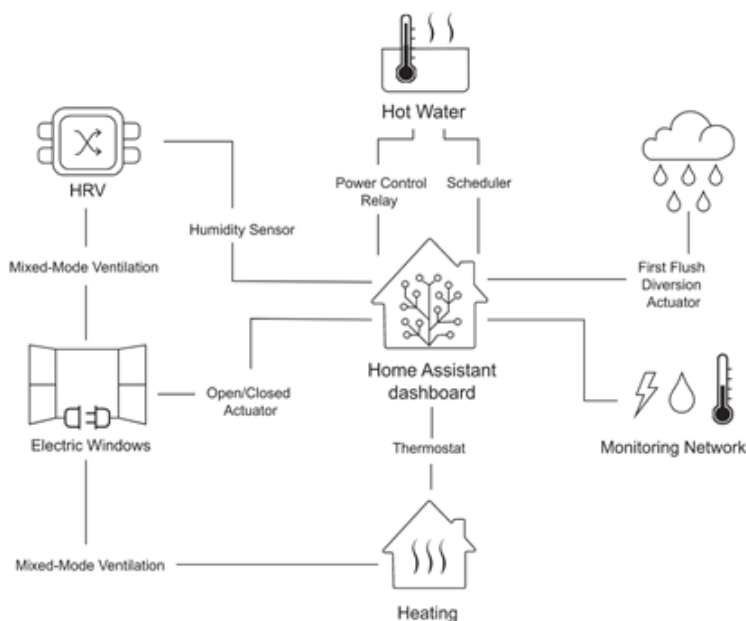
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Smart City x Third Quadrant Design: Living Learning Lab

With an increasing interest in automation across all technology sectors, smart homes have become a major frontier of innovation on the transition to a greener planet. To become a leading innovator in the smart home field, UBC Smart City participated in the 2023 Solar Decathlon Build Challenge as an integral part of UBC's Third Quadrant Design team. UBC Smart City plans to implement a complete smart home system within Third Quadrant's building design.

In April 2022, the smart home plan was approved by competition judges, allowing the group to continue its design process. For the coming year, UBC Smart City will work closely with Third Quadrant Design to further improve and implement our design. After the building is judged for the Solar Decathlon Challenge, it will serve as a 'Living Learning Lab' where students in Applied Science and Architecture can collaborate, conduct research, and study.

Smart Controls



- Architecture
- Engineering
- Market Analysis
- Durability and Resilience
- Embodied Environmental Impact
- Integrated Performance
- Occupant Experience
- Comfort and Environmental Quality
- Energy Performance



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Team Roster 2021-22

Student Team Members

Name	Program	Contributions
Benjamin Corbett Captain	Civil Engineering	Team Organization; Social Media; Queue Counter Technology: Ideation, Solution Development, Proposal Writing and Editing, Technical Advisory
Aliya Zhang Transportation Lead	Civil Engineering	Team Organization; Queue Counter Technology: Ideation, Lead Proposal Writer, Solution Development
Sijan Poudel Transportation Lead	Computer Engineering	Queue Counter Technology: Ideation, Lead Programmer (Front-end & back-end), Technical Advisory
Josh Broberg Transportation Lead	Civil Engineering	Queue Counter Technology: Ideation, Proposal Writing and Review
Kyle Beltran Transportation Team	Civil Engineering	Queue Counter Technology: Ideation, Proposal Writing and Review, Testing Site Management
Aidan Shields Transportation Team	Honours Computer Science & Physics	Queue Counter Technology: Ideation, Programming Support, Technical Advisory
Nish Manesh Transportation Team	Civil Engineering & History	Queue Counter Technology: Ideation, Programming Support
Han Cho Transportation Team	Computer Engineering	Queue Counter Technology: Ideation, Lead Hardware Integration, Technical Advisory, Programming Support
David Huang Transportation Team	Civil Engineering	Queue Counter Technology: Ideation, Proposal Writing and Review, Hardware Support
Chia-Sheng Lin Transportation Team	Computer Science	Queue Counter Technology: Ideation, Programming Support
Abbey Seneres Transportation Team	Civil Engineering	Queue Counter Technology: Ideation, Proposal Writing and Review
Pranay Dang Transportation Team	Engineering	Queue Counter Technology: Ideation, Proposal Writing and Review
Sant Sumetpong Transportation Team	Engineering	Queue Counter Technology: Ideation, Programming Support
Kevin Cui Transportation Team	Engineering	Queue Counter Technology: Ideation, Proposal Writing and Review



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Name	Program	Contributions
Peter Kim Energy Team	Electrical Engineering	Building Energy Modelling: Data acquisition, Data sorting, Final Model, Project Report, Tableau
Ezekiel Camacho Energy Team	Engineering	Building Energy Modelling: Data acquisition, Final Model, Project Report
Osbert Yu Energy Team	Civil Engineering	Building Energy Modelling: Data acquisition, Draft Model
Yashi Prakash Energy Team	Engineering	Building Energy Modelling: Ideation
Sujith Shetty Energy Team	Civil Engineering	Building Energy Modelling: Ideation
Harshit Srivastava Energy Team	Clean Energy Engineering	Building Energy Modelling: Ideation

Advisors

Name	Position	Contributions
Dr. Omar Swei Faculty Advisor	Assistant Professor, UBC Department of Civil Engineering	Organizational support; Automated Queue Counting: Advisor; Building Energy Modelling: Advisor.



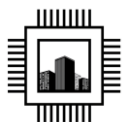
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Looking Ahead

Next year, Peter Kim, a third year electrical engineering student, will be taking the lead as the new UBC Smart City team captain.

For the 2022-2023 academic year, UBC Smart City will undertake more innovative projects and competitions to learn and grow our presence in the smart city space. We will focus on combining software, data analysis, and the interests of our two sub-teams to further improve the precision, scale, and practicality of our ideas. Using that edge, the team will look to compete at not only a regional but an international level. In doing so, we will attract fellow students to employ their skills, collectively building better cities for all citizens.

UBC Smart City holds a body of talented and ambitious student leads who are willing to take on challenging problems. These problems solve require creativity and intelligence, but also determination, because innovative solutions are absent from many precedents. With the progress made so far, the team is confident we will become North America's finest Smart City engineering student design team.



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Sponsorship

Interested in sponsoring our innovators? Your support enables us to participate in competitions, invite guest speakers to inspire the team, and purchase materials for our projects. These activities provide students with first hand experience developing efficient processes and technologies that will advance tomorrow's cities.

All sponsorship levels will increase your brand exposure and showcase your commitment to innovation. As a team sponsor, your company will be featured on our [team website](#) and on the second page of next year's annual report.

Higher sponsorship levels unlock unique opportunities to promote your organization. In addition to the listed benefits, this could include exclusive access to team member resumés, promotion of job opportunities, or the opportunity to present directly to team members.

Sponsorship Levels	Gold \$1500+	Silver \$1000+	Bronze \$500+
Logo on team website	Large	Medium	Small
Logo in annual report	Large	Medium	Small
Post on social media	✓	✓	
Logo on team merchandise*	✓		
Logo on team banner*	✓		
Logo on competition deliverables	✓		

*Specific merchandise and banner purchases TBD.

Please contact the team captain at ubcsmartcity@gmail.com if you are interested in sponsoring!