

Sustainable Smart Campus Net-zero Journey:
Innovation Challenge

Project list (English Only)

Winner

EcoPrana - a net zero pavilion for HKUST members to relax and reduce stress

EcoPrana

a net zero pavilion to empower wellbeing

UST IS STRESSED OUT!

- 50% of students and 60% of staff are struggling with distress
- Academic focused culture, not enough focus and talks to encourage achieving eustress



NON-HUMANISTIC DESIGNS

- Lacks health-focused facilities AND nowhere to simply lie down & relax
- Sophisticated designs may not be better than nature (in terms of both health and energy usage!)

BREATHING GLASS

- Two layers structure: Translucent solar panels & photoactive glass
- Rhythmic light transmission → mimic relaxing breathing



HYDROFEATURES

- Collect rainwater from runoffs and potentially domestic AC condensation
- Used for irrigation of green wall
- Further collected to pass through a calming water turbine for calming sounds



NATURE SOUND SYSTEM

- Inspired by existing SSC project, relaxing micro-therapeutic sound will be played in the space
- include recordings HKUST's birds & natural sound of running water.



MINDFUL BUILDING MATERIALS

Construct with materials like mask-fiber bricks, recycled glass & bamboo

Moss used on green wall can improve indoor air quality and reduce dusts

Flexible furniture for mixed use purposes



Why can it benefit both campuses?

- Distress would probably be a universal issues under UST's culture
- Plenty of natural scenery and water resources on both campus
- Transferring existing SSC projects on CWB to GZ, and making them visible!



First runner-up

Wasteless Canteen - a waste reduction program in HKUST canteens

WASTELESS CANTEEN

From less waste to
"WasteLess"

RECEIPT-LESS



REDUCE REDUCE REDUCE

Use the e-receipt

- ✓ Paper-free
- ✓ BPA-free

More or Less?
White or Red?

RETHINK RETHINK RETHINK



YOUR RICE YOUR CHOICE



WASTE TO VOTE

Vote with recyclables

- ✓ Engaging social experiment
- ✓ Make recycle fun

RECYCLE

Brought to you by:

Cindy, Figgy, Johnson, Michelle

Second runner-up

Close the Gap - a mobile app that promotes sustainable behaviors

A NEW ERA

Close The Gap

**SUSTAINABILITY
SYSTEM
INNOVATION**

My Data

Carbon emissions saved today 1290.5

Weekly target 1000g

Weekly Report 0/500 (20/30)

Carbon Emissions saved today 1290.5

Monthly Report 0/1000 (60/20)

THE HOME OF SUSTAINABLE INCUBATION

CLOSE THE GAP

- CTG platform is designed to connect our sustainable smart campuses together with millions of improvement ideas.
- With a tap of student ID or by scanning QR code, you can update your progress in carbon emissions saving to our platform

PROFESSIONAL COMMUNITY

GET INVOLVED

- Making sustainable behaviors visible and quantifiable;
- Nurture Students' habits with multi-dynamics sustainable events in Both Campuses

Carbon emissions saved

Today 1021.8, 899.2, 1871.6

1021.8g of carbon emissions are equivalent to:

past 31 days

records of the past month:


2022.06.06 Mon	1,999 g
2022.06.05 Mon	1,999 g
2022.06.04 Mon	1,999 g
2022.06.03 Mon	1,999 g

Mark and Reward your contribution to sustainability with

- blockchain certificates
- memorable souvenirs

Scan our QR code, and have a taste of our **PROTOTYPE!**

There are more pages unshown waiting for you to explore!



HKUST Sustainability Ambassador

Chris Lam Denise Chung Anneena Lee Sylvia He Jane Wang

HKUST Sustainability

Other participating teams:

TURING - a net-zero campus using artificial intelligence

TURING: neT-zero campUses based on aRtificial INtelligence
Junjie ZHAO | He ZHANG | Fuling WANG | Weijia ZHANG | Jindong HAN | Weiyu GUO

Perception
Based on the automatically collected carbon emission data from the campus, extracting information automatically, parsing the data automatically and establishing an interactive network to achieve completion automatically

Prediction
Building a framework for joint data representation, proposing a cross-domain knowledge migration algorithm, and achieving accurate prediction of campus electricity consumption in complex scenarios based on the informer model

Planning
Accurately analyze and assess the energy demand of equipment, adaptively adjust and optimize the campus energy use strategy, achieve our final goal of building the AI-driven smart net-zero campuses in CWB and GZ

AI is a differential equation
Net-zero is a boundary condition

Vote for TURING!

Scan here to know more!

The poster features three main sections: Perception, Prediction, and Planning. Perception includes a satellite map and a network diagram. Prediction shows a diagram of an encoder-decoder neural network. Planning features a bus and a reinforcement learning diagram. A QR code is located in the bottom right corner.



Green Beacon



HKUST with Green, Sustainable and High-Performance IoT

Objective

HKUST members need a way to enhance food and campus experiences because they can be more productive, less stressful and be smart, strong and sustainable.

Applications

- > Healthy and Delicious Foods
- > Enhance Dining and Campus Experiences
- > Marketing Contents and Food Promotions
- > Asset Tracking and Indoor Navigation



Operation



Beacon



Customer Interaction



Content Cloud Server

Prototypes

- > Fixed angle, One-time and auto-adjustable panel angle
- > Cloud and analytic solution
- > More sustainable and efficient than conventional battery-powered beacons



luXbeacon





AEXBeacon

The Team



Perm Soonsawad
Muhammad Zeshan Akber
Yeming Zh



[1] P. Soonsawad et al, "BLE Beacons for IoT Applications," *IEEE IoT Journal*, 2018.
[2] P. Soonsawad et al, "Adjustable Solar Panel for BLE Beacon," *IEEE CPSCom*, 2019.
[3] P. Soonsawad et al, "One-time Adjusted Solar Panel for BLE Beacon," *IEEE VTC*, 2021.


FROM ANXIETY TO ELECTRICITY ⚡

**Wanna charge
your phone &
recharge
yourself ?**




**GET ON OUR
ELECTRICITY-
GENERATING
BIKES!**

Sustainable


Generate alternative energy for the campuses & allow you to charge your phone

Convenient

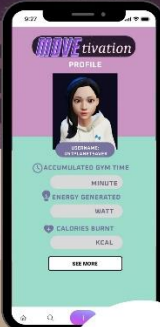
Available at different spots of the campuses & remind you to maintain physical health

Stress-relieving


Allow you to take a quick break from your study & give yourself endorphins to boost your mood




Make it fun !



Create your own avatar!
This page tracks your moves & contribution to the environment!






Check the occupancy of the bikes & kickstart your move now!



Interact with other users!
Enhance the connection between HK & GZ campuses!

Presented by:

Angela Leung Anson Wan Sammi Cheng

CL·AIR·RENEW

Air filtration system tackling NO2 emissions and PM 2.5 particles, powered by the very thing causing them - moving vehicles



ALBUQUERQUE Loika
BOMBLA Sources
BOOKHART-TSAI Kirby
HO C Jun
REY Eniko

PROBLEM

Hong Kong's Roadside pollution has stayed double that of WHO's recommended safe level. HKUST has a steady flow of vehicles contributing to NO2 and PM10 emissions across the campus. Franchised busses in Hong Kong alone are responsible for one fifth of all air pollutants in Hong Kong. Guangzhou has been affected by pollution heavily enough for citywide busses to be revamped to electric. It is unknown if Campus shuttle busses will be electric or not.

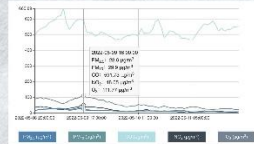


Fig. Emission levels reported at the Astoria, Oregon Campus Air Network (SCAN, HKUST)

The recommended NO2 levels as mentioned by WHO must stay less than 40 µg/m³. We estimate this to be higher across the South Bus Station or areas where vehicles traverse more frequently. Monitoring the air is not enough. Filtering and treating the air sustainably is the need.

REQUIREMENT



Fig. MANN+HUMMEL Filter Cube III Column II MP1 is 400x130x130 mm (height)

Products such as the MANN+HUMMEL Filter Cube helps to improve air quality in places with high air pollution - such as traffic junctions / busy roads or bus stations. A filter column with three Filter Cubes is able to clean 14,500 m³ of air every hour and consumes 1500 W per hour.

It may not be necessary to power this air filter 24 hours a day, but to turn it on when needed with a relay switch connected to the SCAN network to understand what levels it needs to be turned on!

NET ZERO COMMITMENT

If the power running the filters is produced from fossil fuel, it seems hypocritical to the mission. A sustainable net zero way to power the filter is to harness wind energy from passing busses!

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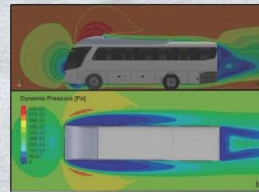


Fig. Pressure pockets around the bus during movement, air flows from high pressure to low pressure areas

South Bus Station	North Bus Station
91M - 93 to 94 times per day	91M - 93 to 94 times per day
91O - 55 to 58 times per day	91O - 55 to 58 times per day
91P - 5 to 6 times per day (not on weekends)	91P 5 to 6 times per day (not on weekends)
291P - 1 times per day (not on weekends)	11 - 90 to 91 times per day
11 - 93 to 91 times per day	70M - 63 to 62 times per day
11S - 76 to 77 times per day	11M - 239 to 238 times per day
104 - 116 to 117 times per day	12 - 56 to 67 times per day (on sunday 53 to 54 times per day)



Fig. Acoustic Wind Turbine Wall, Concept by Jan Stouart

Several consistent busses moving creates emissions on campus but also causes airflow which can be harnessed by vertical wind turbines.

This concept with a vertical wind turbine wall is capable of producing a severely conservative estimate of 6-10 kWh in a day. This energy is what will help clear the air!

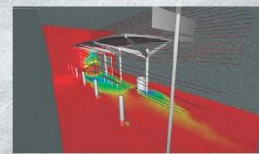
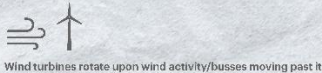


Fig. CTD air flow and flow visualization by Ronald Zoufanah University of Ottawa



Wind turbines rotate upon wind activity/busses moving past it

NO₂, PM10, and other particulate air pollutants cleaned by MANN+HUMMEL Air Filters

~6kWh Power Produced

NO₂
Recycled levels of Nitrogen dioxide is used to create the world's most powerful and sustainable fuel cell. It is used to create clean energy and reduce CO₂ emissions. It is a key component of the world's most advanced energy storage system.

NO_x
Nitrogen dioxide is a toxic air pollutant that is a major component of smog. It is a key component of the world's most advanced energy storage system.

RSP
Respirable suspended particulates are a mixture of solid and liquid particles that are inhaled and can cause respiratory and cardiovascular problems.