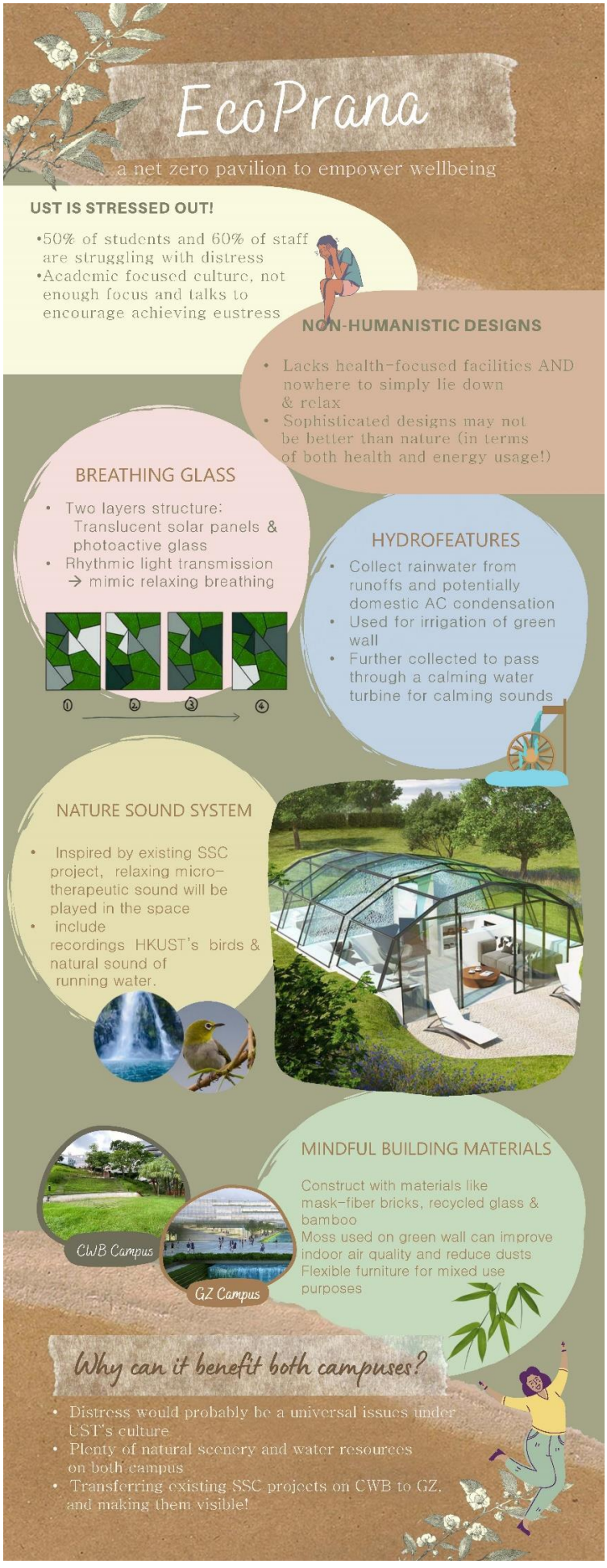
Sustainable Smart Campus Net-zero Journey:

Innovation Challenge

Project list (English Only)

Winner

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

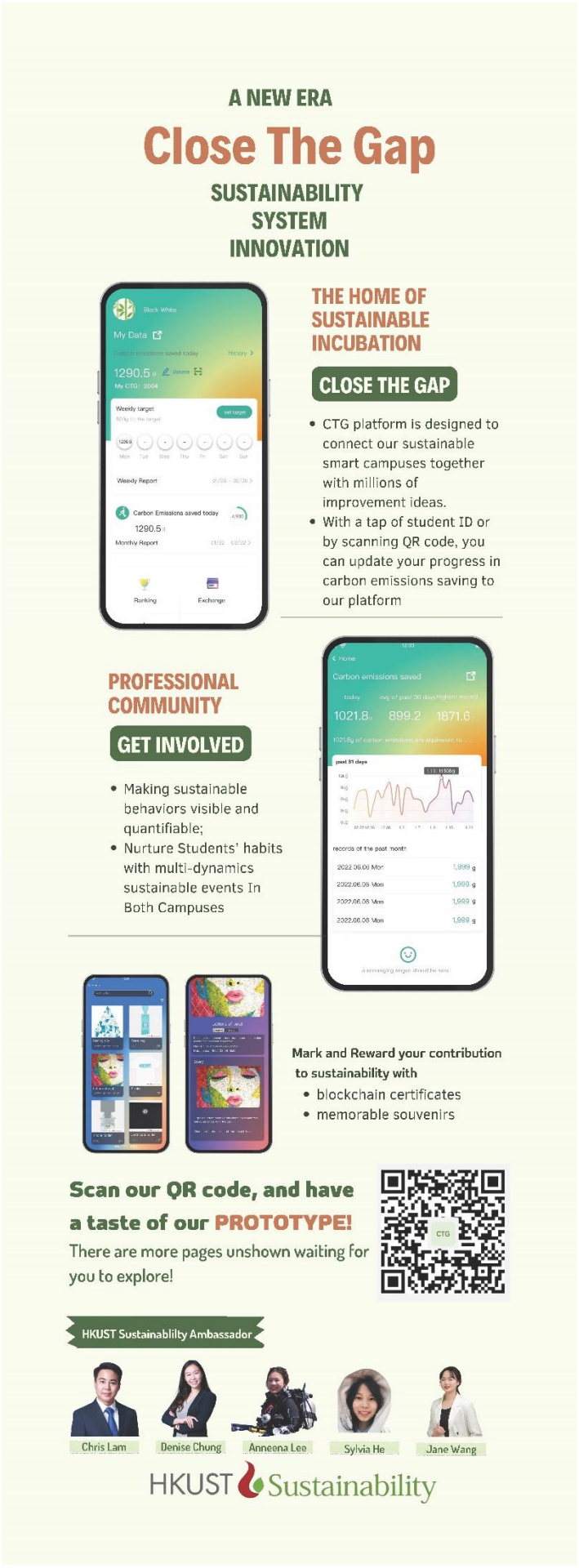


First runner-up

Wasteless Canteen - a waste reduction program in HKUST canteens

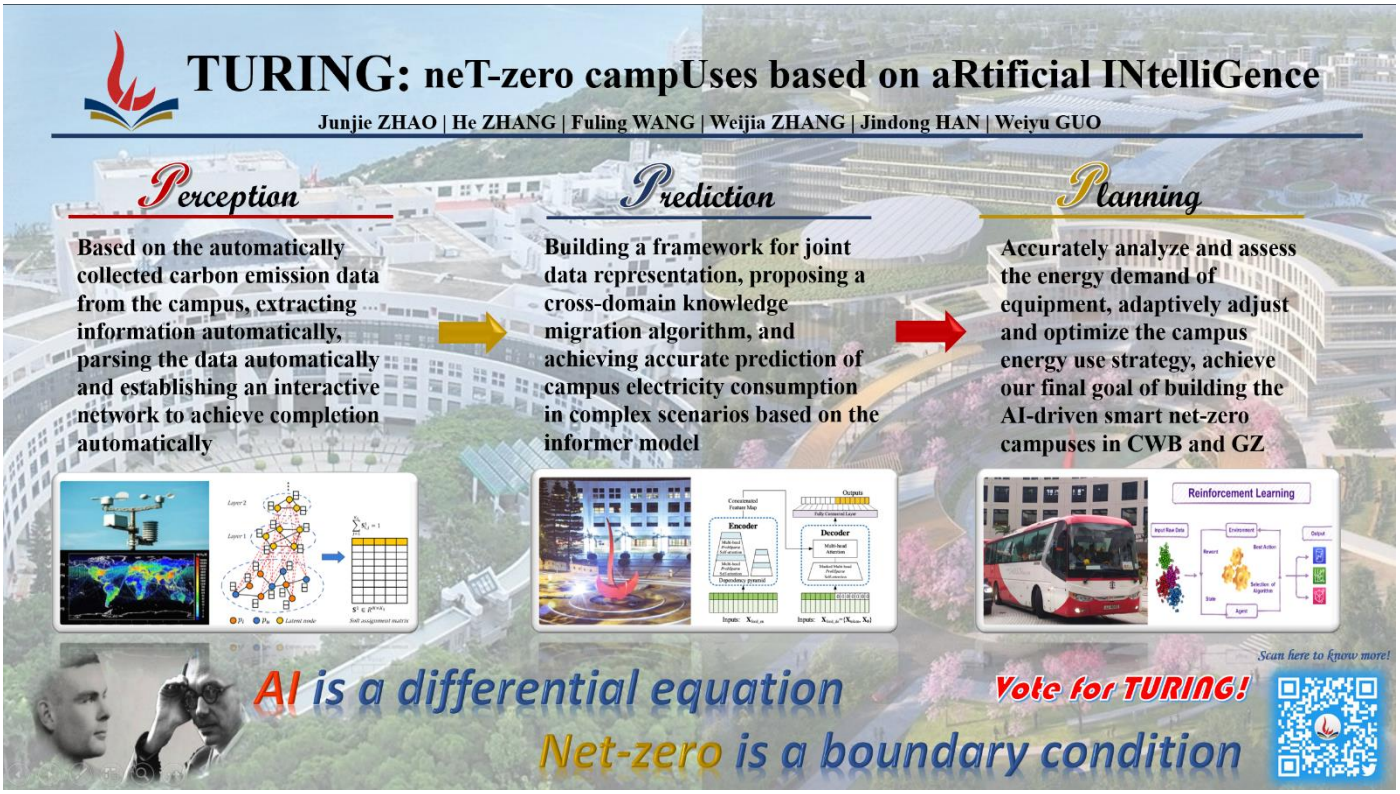
Second runner-up

Close the Gap - a mobile app that promotes sustainable behaviors

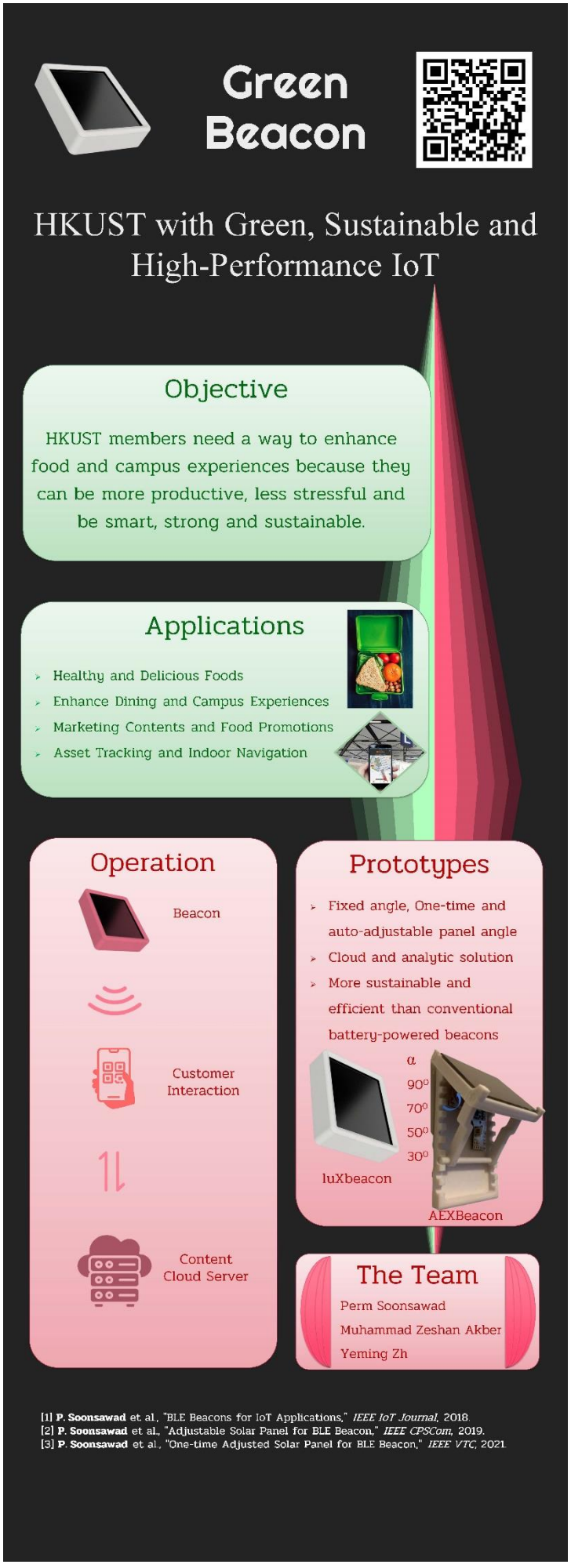


Other participating teams:

TURING - a net-zero campus using artificial intelligence



Green Beacon - improving campus user experiences using IoT



MOVEtivation - a mobile app linking to electricity-generating bikes

CL Air Renew - power air filtration system using wind energy

CL·AIR·RENEW

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

ALBUQUERQUE Laila
BIDAULIA Gaurav
BOOKHART-TSAI Kirby
HO C Jun
REY Elvira

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.

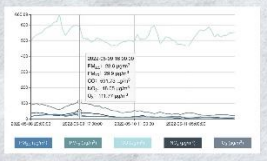


Fig. Emission levels reported at the Atrium, Smart Campus Air Network (SCAN, HKUST)

The recommended NO2 levels as mentioned by WHO must stay less than 40 μg/m^3. 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

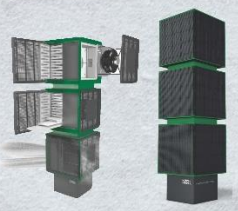


Fig. MANN + HUMMEL Filter Cube III Column (1 M^3 in width, 3 M^ Height)

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 travels from high pressure to low pressure areas

South Bus Station
91M - 93 to 94 times per day
90 - 55 to 56 times per day
91P - 5 to 6 times per day (not on weekends)
291P - 1 time per day (not on weekends)
11 - 90 to 91 times per day
116 - 76 to 77 times per day
104 - 116 to 117 times per day

North Bus Station
91M - 93 to 94 times per day
90 - 55 to 56 times per day
91P 5 to 6 times per day (not on weekends)
11 - 90 to 91 times per day
792M - 61 to 62 times per day
11M - 239 to 238 times per day
12 - 66 to 67 times per day (on sunday 53 to 54 times per day)

Fig. Aesthetic Wind Turbine Walls. Concept by Joe Doucet

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!

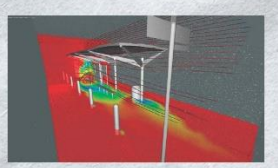

Fig. CFD analysis and flow visualization by Reinhard Bouffanais University of Ottawa