

Smart Nation Research at NUS

Super cluster to collect and share data for innovative solutions

Presented By:



A virtual university on Kent Ridge campus will be an ideal testbed for new ideas

Written by Grace Chng

The National University of Singapore (NUS) wants to use its Kent Ridge campus as a testbed for future solutions relating to transportation, security and remote learning, as part of its efforts to support the Smart Nation initiative.

NUS Deputy President (Research & Technology) Professor Ho Teck Hua points out that Kent Ridge — a mini-town with a community of 50,000 students and staff — can be a showcase for a virtual Singapore. Lessons learnt and new technologies and solutions developed here can be translated for use nationwide.

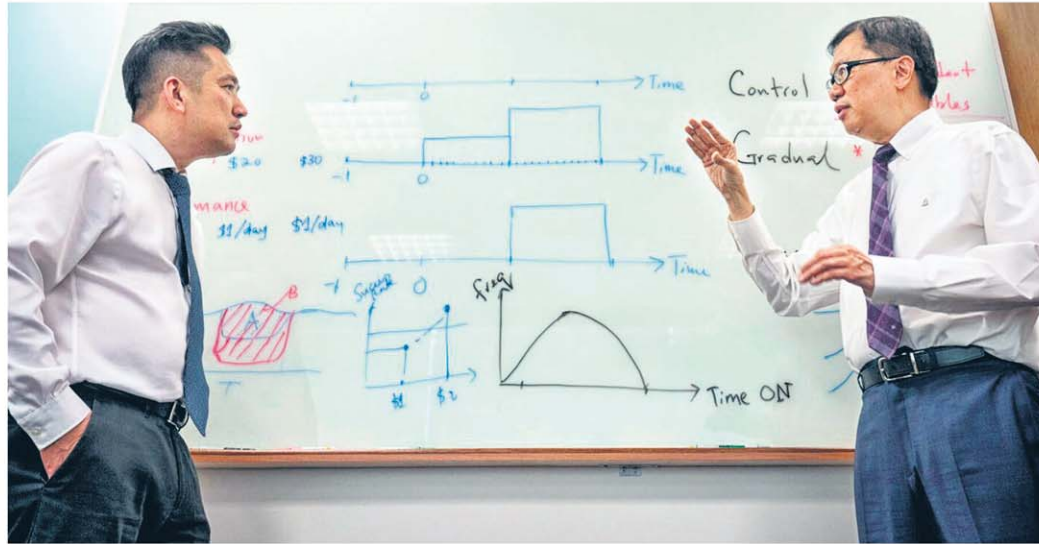
Data collected can be crunched and innovative solutions proposed. For example, students and staff can find answers to questions like: What is the best restaurant for lunch that is the least crowded? Who is my best study partner for this exam?

These scenarios are possible only because data are available, anonymised and shared, says Prof Ho.

A cluster of expertise

Data collection and computation, and creating new solutions are the key pillars of the NUS Smart Nation Research Cluster, which was formed earlier this year to support the national initiative.

Under this cluster, the university will bring together multi-disciplinary areas — from the social sciences, humanities and business to engineering, sciences and medicine — to create a platform that can develop interesting solutions with users, which could be commercial companies or public sector agencies, says Prof Ho.



NUS Deputy President (Research & Technology) Professor Ho Teck Hua (right) discussing Smart Nation Research Cluster issues with Professor Andrew Lim (left), head of Industrial and Systems Engineering at NUS Engineering.

Space to think

A dedicated hub with the fastest wireless access available in Singapore will soon be developed on campus to support the "brain-heavy", computation-intensive work. There will be no labs but plenty of spaces for experts from different disciplines to hang out and talk through ideas.

Says Prof Ho: "There will be white boards on every wall where people can share ideas and equations. They will talk data, computation, cyber security and business solutions. There will also be a 'hangar', where start-ups may be spun out from these discussions."

The cluster also focuses on manpower development. Over the next few years, between 700

and 1,000 researchers and PhD students will be involved in data science, logistics, cyber security, precision medicine, retail analytics and other areas. Some will also collaborate with top-tier universities like the University of Cambridge and the University of California, Berkeley.

NUS will provide research grants to about 30 to 40 researchers in the hope that some of the research will be translated into commercial products and services.

The cluster includes a new NUS Institute of Operations Research and Analytics which will mobilise NUS' existing strengths in diverse disciplines to create integrated capabilities in modelling and computation. Work has already begun. One project is on last-mile

delivery operations with smart devices, to support the Government's vision of having a locker system where logistics providers can deliver goods and consumers can easily and conveniently collect them.

The NUS Institute of Data Science has also been set up. At steady state, about 100 researchers from different disciplines will be working with industry partners and government agencies to develop innovative solutions to address challenging real-world problems. Microsoft is the first industry partner.

Sharing data securely

Professor Andrew Lim, a leading authority in computational management science, says these

programmes and activities in data science are important because they show how data can be shared openly and securely.

While there is a lot of buzz on data science, he acknowledges that many organisations are still afraid of sharing data because of privacy concerns.

"But data science is about changing behaviour. Our technology can show that data can be aggregated and shared in a way that preserves privacy and provides anonymity. We want to work with more organisations to do this," says Prof Lim who is head of Industrial and Systems Engineering at NUS Engineering.

The role of Virtual NUS

The new Virtual NUS project will

allow the university to collect data and create innovative solutions that will benefit the connected community of students and staff who live, eat, work and play at the Kent Ridge campus.

Prof Lim says: "We want to make Kent Ridge a centre where people come to learn about collecting data and keeping those data private, secure and anonymous. We hope to get the first useful solution by June next year."

Cyber security initiatives

A big area of focus for the university's Smart Nation Research Cluster is cyber security, which Prof Ho describes as a "necessary hygiene factor" because "data science needs security".

Several initiatives have been set up. One is the Singapore Cybersecurity Consortium supported by NUS and the National Research Foundation (NRF) Singapore. With 20 industry partners as members, it will focus on manpower development and promoting greater awareness, adoption and translation of cyber security technologies.

Another initiative is the NUS-Singtel Cyber Security R&D Laboratory. It will conduct research and develop capabilities and innovative digital solutions to address a broad range of cyber threats. It will also train about 120 new cyber security professionals from undergraduate to post-doctoral levels over five years.

Then there is the National Cybersecurity Research Lab at NUS Computing, which is funded by NRF Singapore. It is a shared national infrastructure where the local cyber security research community and industry can work on vulnerability assessment.

Welcome to the Kent Ridge living lab

Virtual NUS is a data-driven project. Every building and all objects in them — including white boards, projectors and water coolers — will be mapped. Data on people movements

and wireless traffic will also be collected. However, privacy will not be compromised as the data will be anonymised. All these data will be computed and analysed to give an overall

view of how the Kent Ridge campus is operating. To distribute the information, apps can be created. A university app store is already in the pipeline.

Virtual NUS
This initiative sees the transformation of the flagship Kent Ridge Campus of NUS — with its connected ecosystem of 50,000 students and staff — into a digitally pitched living laboratory allowing for exploration of design, development and testing of innovative big data applications and solutions.

By monitoring the increase in passenger traffic at specific areas and times, predictive real-time deployment of buses improves the internal shuttle bus service. Virtual NUS involves the capture of big data through campus-wide sensors and mobile devices connected to the NUS network. Data is computed and examined to create an analytics plan in innovating the way we learn, live, work and play.

Other Virtual NUS applications
By monitoring signals from smart phones and devices on campus, finding a less crowded place for lunch, for instance, or an under-utilised lecture theatre or meeting room are just other viable possibilities.

Study Buddy App
1 The app matches users with others in the same discipline of study or with similar interests.
2 Users can then connect and organise to meet up by creating a study group.
3 Based on real-time data analytics, the app also suggests locations around campus conducive for group study or discussion.

Airbus-NUS partnership takes flight

Next year, students and lecturers at the National University of Singapore (NUS) will see drones delivering their letters and small parcels around Kent Ridge campus.

Called Skyways, this will be part of a national project between Airbus Helicopters and the Civil Aviation Authority of Singapore to conduct proof-of-concept trials on the use of Unmanned Aircraft Systems (UAS) to deliver parcels

in an urban environment.

NUS is supporting the first phase of Skyways by providing the Kent Ridge campus as a testbed for UAS deliveries. In addition, NUS researchers will also work with Airbus to develop engineering control systems to optimise the traffic flow of Skyways drones. It will also develop appropriate cyber security solutions to protect the UAS from cyber attacks.

What's next?

With the success of the first phase, Airbus will pilot test the use of Skyways drones to carry parcels to ships anchored off Singapore's harbour. NUS researchers will continue to assist Airbus with the development of the flow control systems and cyber security solutions for the second phase of Skyways.

SKYWAYS
Airbus' Skyways project aims to provide efficient, seamless delivery of small parcels to students and faculties via drones across the National University of Singapore's campus.

Pilot Case A
Delivery of parcels on the National University of Singapore's (NUS) campus through Skyways network.

Pilot Case B
Delivery from parcel tower to ships. This use case will be explored upon successful completion of pilot case A.

Drones will operate simultaneously across the campus.
Drones will operate using defined 'aerial corridors'.

1 The Skyways drone is an octocopter that carries air transport containers loaded on its underside.
2 The drone flies a fully automated route, landing on a designated landing pad.
3 Once landed, the drone is unloaded automatically.
4 End customers receive a delivery notification on their mobile phone to come pick up the parcel at the parcel station.

Source: Airbus Group
Infographic: © beatrixsantacruz / Airbus Group

NUS Smart Nation Research Cluster

This cluster brings together top researchers from multi-disciplinary backgrounds of engineering, mathematics, medicine, computing and the social sciences to create powerful solutions that will enhance the way Singaporeans live, work and play.

The cluster comprises:

- Institute of Data Science
- Institute of Operations Research and Analytics
- National Cybersecurity R&D Laboratory
- NUS-Singtel Cyber Security Research and Development Laboratory
- Singapore Cybersecurity Consortium
- Virtual NUS

Visit smartration.nus.edu.sg for more information.

This is the last instalment of a three-part series on the Smart Nation initiative and NUS contributions to the national strategy.