

# NUS team develops smart socket system for plugged-in devices

Users can remotely switch off appliances, set it up to shut down gadgets drawing too much power

Cara Wong

Have you ever left home and realised a fan was still running, a laptop charging, or even that the electric stove was still turned on?

None of that would be a problem if you could use an application to remotely switch off the appliances or even configure your electrical sockets to automatically shut down gadgets that draw too much power.

A team of National University of Singapore (NUS) researchers has devised a smart electrical socket system that allows users to remotely control sockets.

It can recognise appliances that are plugged into the sockets, even if they are not "smart" by nature.

Dr Krishnanand Kaippilly Radhakrishnan, one of the researchers on the team, said he got the idea for the system when he was looking into reducing energy consumption in buildings as part of his PhD research.

He found there was a problem with "plug load" energy consumption, as plugged-in devices draw power even when they are idle for long periods of time.

"You have a piece of equipment that is on 100 per cent of the time, but people are only around for 30 per cent of the time. There are so many appliances that are unnecessarily plugged in and they are wasting energy," said Dr Krishnanand.

He added that smart appliances in the market generate a lot of electronic waste and drive up costs, as manufacturers typically put individual computing units in every appliance.

"The correct way would be to make the building smart, instead of filling it with many smart items from many different manufacturers," he said.

The NUS team's system has three components: wall outlets outfitted with a communication unit, near-field communication (NFC) "stickers", and server software and an app for monitoring and controlling the system.

To use the smart sockets, users first affix a unique sticker to the plugs of their devices.

They then "pair" the unique sticker to the device by indicating – in an online database – which device the sticker is attached to.

When the appliance is plugged in, the smart socket recognises the device through the sticker's NFC technology and it communicates this via Wi-Fi to a central server, which monitors the power flow to the devices.

Ultimately, the user has control of the socket, by "communicating" with it through its Wi-Fi module.

Associate Professor Sanjib Kumar Panda, the team leader of the project, said the system allows users to know which specific appliances are plugged into the sockets.

It can then detect anomalies and alert the user.

For example, if a stove or an electric kettle is drawing more current than what it is rated for, the smart system automatically cuts off the power and alerts the user – hence preventing fires.

## Smart electrical socket system

### HOW IT WORKS



1 Fix a unique "sticker" onto the plug of your device.



2 "Pair" the unique sticker to the device by specifying in an application what device you are using, and its specifications.



3 When the device is plugged in, the smart socket recognises the device via the sticker's near-field communication technology.



4 The socket communicates with a server via Wi-Fi.



5 The server continuously monitors the power being drawn from the socket.

### HOW IT CAN BE USED



**Scenario 1: Overloaded plugs**  
The system can detect when too much power is being drawn by an appliance. It could be programmed to automatically switch off the socket, preventing the appliance from overheating and causing a fire.



**Scenario 2: Remote-control operations**  
Users can remotely control their appliances by switching the socket on and off through a mobile application.



**Scenario 3: "Physical firewall"**  
The system can be configured to "reject" stickerless devices, as it can deny power from being drawn. This prevents users from charging or using unauthorised devices that do not have the stickers.

Source: NATIONAL UNIVERSITY OF SINGAPORE STRAITS TIMES GRAPHICS

"The user may or may not know how much current it should draw, but when we pair the device we know how much current the device should draw under healthy conditions, and we keep monitoring that," said Prof Panda.

The system can be configured to automatically switch off plugged-in devices that are not in use to save power.

It can even be used as a way to deny power to unauthorised devices, as the system could block "sticker-less" and other unpermitted devices from drawing power from the smart sockets.

The researchers estimate that their system can potentially save on energy consumption from plugged-in devices to the tune of 30 per cent to 60 per cent.

The team has founded a start-up to commercialise their system.

They hope it will be used in Housing Board (HDB) buildings once it is approved and certified by the relevant agencies.

Smart sockets have been rolled out in selected HDB flats as part of the smart nation initiative.

The Punggol Northshore Build-To-Order project is the first smart-enabled housing project, with flats in Northshore Residences I and II already equipped with inbuilt smart sockets that allow homeowners to track their electricity usage.

But smart sockets cannot be remotely controlled at present and they cannot "recognise" the appliances connected to them.

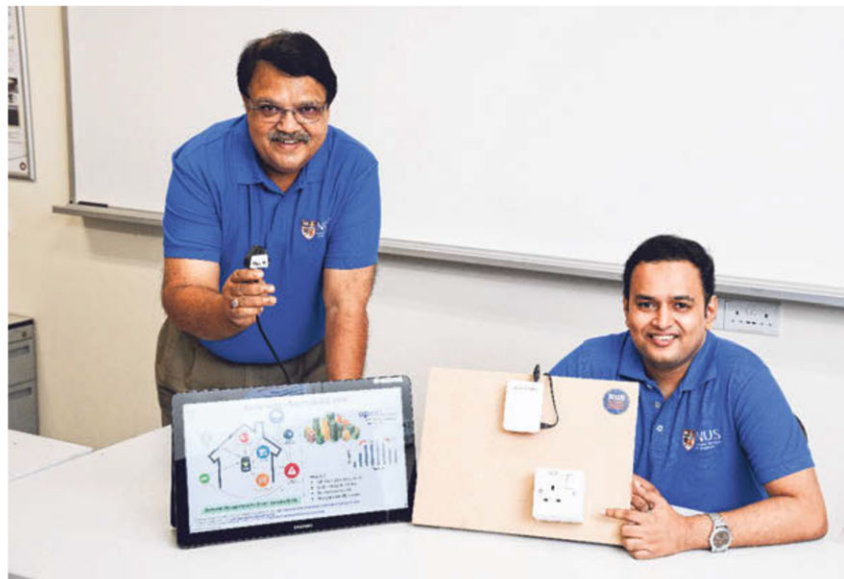
The research team said other companies that have registered interest in the system include Surbana Jurong and DBS Bank.

Certification for this smart socket system is still pending.

The researchers estimate that it could hit the market some time between nine months and a year from now.

Said Dr Krishnanand: "A smart nation should have buildings that are inherently smart."

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Project team leader Sanjib Kumar Panda (far left) and researcher Krishnanand Kaippilly Radhakrishnan with a prototype of their smart electrical socket system, which can recognise appliances that are plugged into the sockets, even if they are not "smart" by nature.  
PHOTO: NUS



Flats in the Housing Board's Northshore Residences I in Punggol are already equipped with inbuilt smart sockets, but these cannot be remotely controlled at present and they cannot "recognise" the appliances connected to them. The NUS team hopes their system will be used in HDB buildings once it is approved and certified by the relevant agencies.  
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Smart appliances in the market generate a lot of electronic waste and drive up costs, as manufacturers typically put individual computing units in every appliance, said Dr Krishnanand Kaippilly Radhakrishnan. "The correct way would be to make the building smart, instead of filling it with many smart items from many different manufacturers," he said.

30%-60%

Estimated energy savings from plugged-in devices that the smart socket system can potentially achieve, according to the National University of Singapore researchers.

9-12 months

Time it would take for the system to hit the market from now. Certification is still pending.