



Welcome to the latest edition of the CDE Research Newsletter — Forging New Frontiers!

The theme of this issue is *From Idea to Reality*.

At the foundation of this issue is a series of breakthroughs at CDE that form the impetus of real-world technical impact and serve as catalysts towards societal and policy impact. Importantly, these innovations showcase the diversity of fields where our CDE community are driving change, from energy and sustainability to sensors and biomedicine.

Examples of our pioneering featured work include a study led by Associate Professor Jimmy Peng (Electrical and Computer Engineering) that proposes a framework for electric vehicle (EV) charging infrastructure to increase accessibility while helping policymakers in planning strategy.

Research by Associate Professor Zhao Dan (Chemical and Biomolecular Engineering) and his team has realised porous crystal technology for highly sensitive and specific gas sensing, which spans chemical detection through atmospheric monitoring.

Assistant Professor Clement Zheng (Industrial Design) embedded interactive circuits into ceramic, taking an everyday material to new heights. This opens doors to everything from touch-sensitive plates to smart flowerpots!

In healthcare, Assistant Professor Eliza Fong (Biomedical Engineering) led research to pioneer the development of a hydrogel capable of markedly prolonging the use of cancer cells for drug testing, which could change how we personalise patient treatment.

Taking a page from nature, Associate Professor Benjamin Tee (Materials Science and Engineering) and his team developed 'eAir,' a pressure sensor that provides vital feedback to doctors in scenarios such as surgical settings.

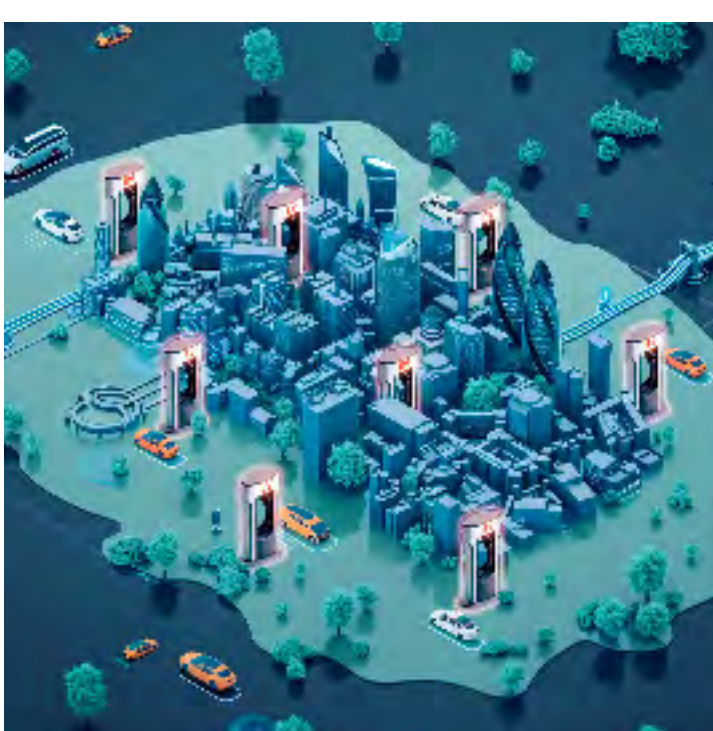
In a major step forward towards chip technologies for everything from smart buildings to wearables, Professor Massimo Alioto is serving as Director of the FD-fAbriCS (FD-SOI Always-on Intelligent & Connected Systems) joint lab, which is markedly enhancing the energy efficiency of chips that power AI devices.

In sum, this issue reveals a profoundly agile ecosystem at CDE that validates innovation and provides a clear path towards large-scale societal and policy impact. Our community is proud to be a cornerstone of bridging ideas with reality.

We hope you enjoy the issue!

Dean Ho

Editor-in-Chief



Supercharging the resilience of the EV ecosystem

Uncovering the impact of urban flooding on the accessibility of EV chargers paves the way for mitigation strategies that help policymakers strengthen the resilience of charging infrastructures.

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Sniffing out gases with precision

Flexible, shape-shifting organic frameworks are capable of sensing gases with high precision for applications in adsorption, separation and storage.

[Read more >](#)



Serving innovation on a ceramic platter

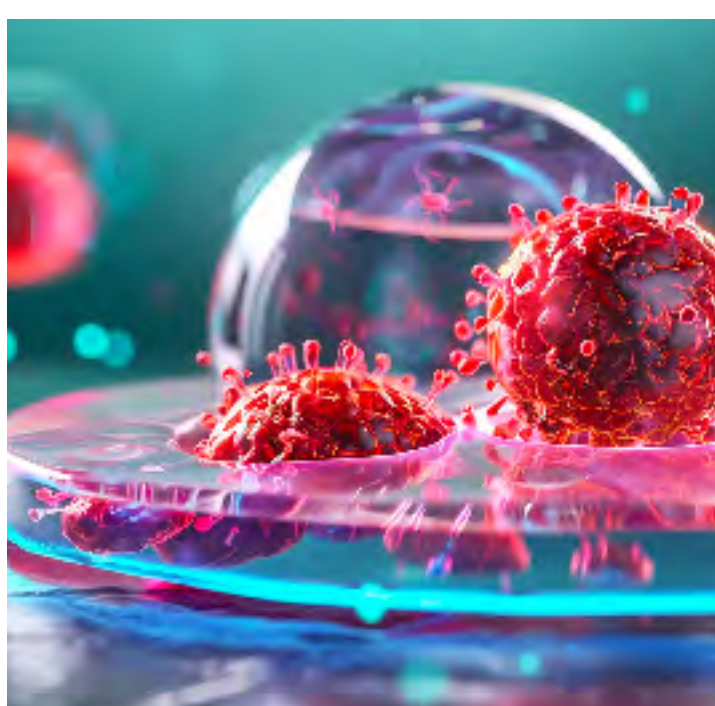
Innovative ceramic wares with built-in electronic circuits are capable of responding to touch, temperature and moisture, blending technology with everyday items to create convenience and connection.

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Keeping cancer cells content

A jelly-like hydrogel platform keeps tumours alive for ten days, enabling an effective testing ground for various anti-cancer drugs and treatments.

[Read more >](#)



Learning from the lotus leaf

Inspired by the lotus leaf, the 'eAir' sensor achieves near-ideal pressure sensing and is applicable in diverse liquid environments, including those involved in medical settings.

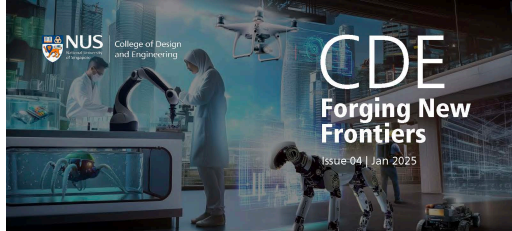
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Turbocharging the energy efficiency of AI processors

Breakthroughs in chip design techniques offer three crucial benefits for AI devices: reduced power consumption, extended battery life and the ability to support intense computational workloads.

[Read more >](#)





Welcome to the first CDE Research Newsletter for 2025!

We are excited to kick off our first issue with a topic that will be a cornerstone of innovation for the NUS CDE community: Robotics!

The field of robotics is vast, and covers highly diverse topical domains that span artificial intelligence, built environment, mechanical engineering, biomedical engineering, electrical and computer engineering, design, and beyond. With regards to applications, everything from healthcare to drones, and construction to disaster relief are poised for major advances due to innovations in robotics.

Importantly, the continued implementation of new robotics technologies into everyday operations across industries will also have far-reaching impact in public policy and the social sciences.

Bridging ideation with real-world impact is a hallmark of NUS CDE, and we're excited to feature our colleagues' amazing work in robotics as we kick off another exciting year from our community. Enjoy!

Dean Ho
Editor-in-Chief



Teaching soft robots self-awareness

Soft robots with human-like perception can anticipate sensory inputs, detect contact and adapt dynamically, paving the way for applications in autonomous exploration and precision-driven medical procedures.

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A robust robotic support system

Driven by a differential series elastic actuator, a novel back-support exoskeleton aids users during lifting tasks, easing strain without adding muscle activation to the back and legs.

[Read more >](#)



Soft robots take on hard tasks

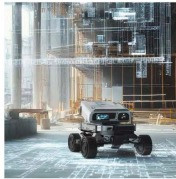
Soft, robust miniature robots powered by fluid kinetic energy can traverse tricky terrains at impressive speeds, offering a valuable new tool for search and rescue operations.

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Lean, mean flying machines

A fast-adaptive estimator for robust flight control draws from the best of both deep-learning techniques and conventional control algorithms to improve drone performance.

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Helping robots find their way around the construction maze

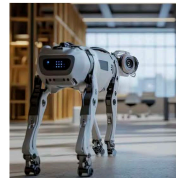
By improving how unmanned ground vehicles see and navigate complex, cluttered construction sites, automation is set to transform tasks like site mapping and monitoring.

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Automating 3D scanning of built environments

By integrating building information with indoor spatial data, robots are equipped with the capability to navigate and map complex indoor spaces more efficiently, advancing how industries capture the digital representation of the built environment.

[Read more >](#)



Teaching robodogs new tricks

Modelled on the neural control systems of animals, a new layered control framework enables legged robots to navigate complex terrains with greater agility and precision.

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Robot safety a top priority

Designing safe, reliable and human-centric robots is a growing priority as they become an integral part of daily life.

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