ANNEX

"AI for Cities" Exhibition Highlights

1. Introduction to AI

Artificial Intelligence (AI) refers to computer systems with capabilities that enable tasks typically requiring human intelligence, such as learning, reasoning, perception, and decision-making across a wide range of applications. As a general-purpose technology with wide applicability across virtually every sector of the economy, AI is expected to augment human capabilities and transform how work is performed.

Journey of AI in the city

Building on the foundation of data science, AI has evolved significantly over the past decades, progressing through several key stages that expanded its capabilities and applications:

- **Data Science** acts as a critical engine for AI, involving the preparation and analysis of data to extract actionable insights for informed decision-making.
- **Machine Learning** is a form of AI that detects patterns in large datasets and learns to make predictions through experience rather than fixed rules.
- **Deep Learning** is a subset of machine learning that uses neural networks to process and interpret images, speech and complex data, enabling computers to recognise patterns with remarkable accuracy.
- **Generative AI (GenAI)** leverages large neural networks, including Large Language Models (LLMs) and Diffusion Models, to learn abstract patterns from data and generate new content such as text, images and video. While LLMs power widely used tools such as ChatGPT, GenAI as a whole encompasses a broader range of creative technologies.
- **Agentic AI** represents the latest frontier in AI development, moving beyond content generation to autonomously execute complex tasks, initiate workflows, and collaborate with other AI agents with minimal human intervention.

2. AI applications in urban planning and operations: From monitoring to anticipating

Machine learning models learn from large datasets to identify patterns that enable early insights and more precise interventions, helping cities better understand how human activity shapes urban systems, and shifting from reacting to problems to anticipating and addressing them earlier.

- Study of Singapore residents' lifestyle routines to promote healthier living (Health Promotion Board and National University of Singapore)
  Using machine learning to analyse how different population groups move through and use shared spaces in their daily lives. The data used in the analysis is anonymised. The findings will be used to help planners to identify gaps in the built environment and design neighbourhoods that make it easier for residents to lead more active, healthier lifestyles.

- Singapore Integrated Transport and Energy Model (SITEM) (A*STAR and the Public Sector Science and Technology Policy and Plans Office)
  As electric vehicle adoption grows, so does the complexity of managing our transport and energy systems. Developed by A*STAR and S&TPPO in close coordination with LTA and EMA, SITEM uses machine learning to make sense of the large and varied datasets across both transport and energy systems, anticipating how they will evolve and simulating different scenarios to support better long-term planning for EV charging and electrical infrastructure.

- Open Digital Platform (ODP) for better facility management (JTC Corporation and GovTech)
  Jointly developed by JTC and GovTech, the ODP integrates data from sensors, cameras, and energy systems across a building into a single, real-time platform. Facility managers can query 'AskODP', a GenAI-powered chatbot, for instant insights on building health, eliminating the need to manually search through reports. In addition, the platform flags issues early, predicts maintenance needs, and automatically optimises energy use.

3. **Interpreting Urban Complexity**

Deep learning takes AI a step further by enhancing our ability to make sense of more complex, unstructured data, through learning from visual and sensor inputs to interpret patterns. This enables urban systems to be monitored more continuously, supporting timely detection and consistent analysis for sharper, more informed decision-making in city management.

- Mapping movement in the built environment (Singapore-ETH Centre)

  Slopes, uneven pavements, and crowded walkways may seem like minor inconveniences – but for seniors, they can pose real challenges to mobility and safety. This project by SEC uses wearable sensors and a robotic scanning platform to collect real-world walking data and map surface conditions. Using feature engineering and a layered suite of AI models – from machine learning to deep learning – the system personalises fall-risk assessment for each individual and pinpoints locations where movement becomes challenging, potentially helping planners and designers create streets and spaces that are safer and more accessible to seniors.

- Smarter estates for better living (Housing & Development Board)

  In a three-year study at Punggol Matilda estate, HDB, together with ST Engineering and Singapore University of Technology and Design (SUTD), deployed equipment with AI capabilities to address two municipal issues: illegal dumping and unexpected water pump failures. Smart cameras leveraging deep learning detect illegal dumping at common refuse areas, while smart sensors tapping on machine learning were installed in pump rooms to predict water pump failures before they occur. The pilot reduced costs for the Town Council and demonstrated the potential of using AI to make estate management more efficient, thus creating a more pleasant living environment for residents.

- Mobile AI detection for safer roads (URA and V3 Smart Technologies)

  Three cameras mounted on patrol vehicles, powered by a deep learning model trained with a large volume of visual references, can now automatically detect

unsafe parking behaviour almost in real-time. The trial of the system by URA and V3 Smart Technologies achieved over 95% accuracy in identifying key types of unsafe parking, and covered far more ground than manual inspections, making prompt follow-up action feasible and enhancing road safety for all road users.

- Non-Invasive building inspection tool (Building and Construction Authority and WaveScan)

  In future, inspecting a building's façade no longer requires invasive procedures or lengthy processes. Developed by BCA and WaveScan under the Cities of Tomorrow[1] (CoT) programme, this handheld scanner sends microwave signals through non-metallic façade surfaces to create 3D images of concealed elements beneath, enabling abnormalities to be detected quickly and safely. Deep learning algorithms analyse the scans, while a vision-tuned Large Language Model generates instant reports with actionable recommendations. The result is a faster, safer inspection process that significantly reduces safety risks, and a meaningful step towards the target of reducing time taken in facade inspection by 50% by 2030, measured against the 2020 baseline.

4. Autonomous Vehicles for Passengers and Goods Mobility

As cities grow, so does the need for more flexible and efficient ways to move people and goods. Autonomous Vehicles (AVs) are rising to meet this challenge, from improving first – and last-mile connectivity to strengthening logistics operations. Singapore is taking a calibrated approach to autonomous vehicle deployment, progressively expanding AV use across both passenger and logistics applications to address evolving urban mobility needs. The result: operations that are more efficient, and a city that functions and evolves more seamlessly.

[1] Launched in 2017, the Cities of Tomorrow (CoT) R&D programme is a multi-agency effort led by MND that seeks to sustain Singapore's success in the decades ahead by leveraging on Research and Innovation (R&I)

- Autonomous Vehicles for people and goods movement (Land Transport Authority, Fairprice-Zelos, Grab-WeRide andComfortDelGro-Pony.Ai)

  In Punggol, autonomous shuttles are already on the roads, improving connectivity for residents by offering new direct routes and visitors. During AV familiarisation, AI (machine learning techniques) are used to train AVs to react appropriately to local road, vehicle and pedestrian traffic conditions, for safe navigation.

  On the logistics front, Singapore has launched its first retailer-supplier autonomous vehicle (AV) transport route, a significant milestone in bringing AVs into everyday supply chains. Navigating planned routes between logistics nodes using AI to process and fuse sensor data for safe operations, while phased deployment and regulatory partnerships have helped build public confidence and strengthen local industry capabilities in the process.

- Turning your ideas into urban visions (URA)
  What if anyone could shape their vision for a future neighbourhood, and see it come to life instantly? URA's Dream Lab makes this possible, using three integrated techniques – direct generation, inpainting, and prompt engineering – to instantly translate user inputs into vivid visual concepts and narratives tailored to Singapore's urban planning context. AI-driven persona simulation adapts the experience based on the user's selected role, while real-time data aggregation surfaces emerging preferences from thousands of concurrent users across different communities and locations.