Thematic Track Session 3.2 (Energy Efficiency)

Improving Energy Efficiency in Buildings

Revolutionising Smart Building Management with Neuron

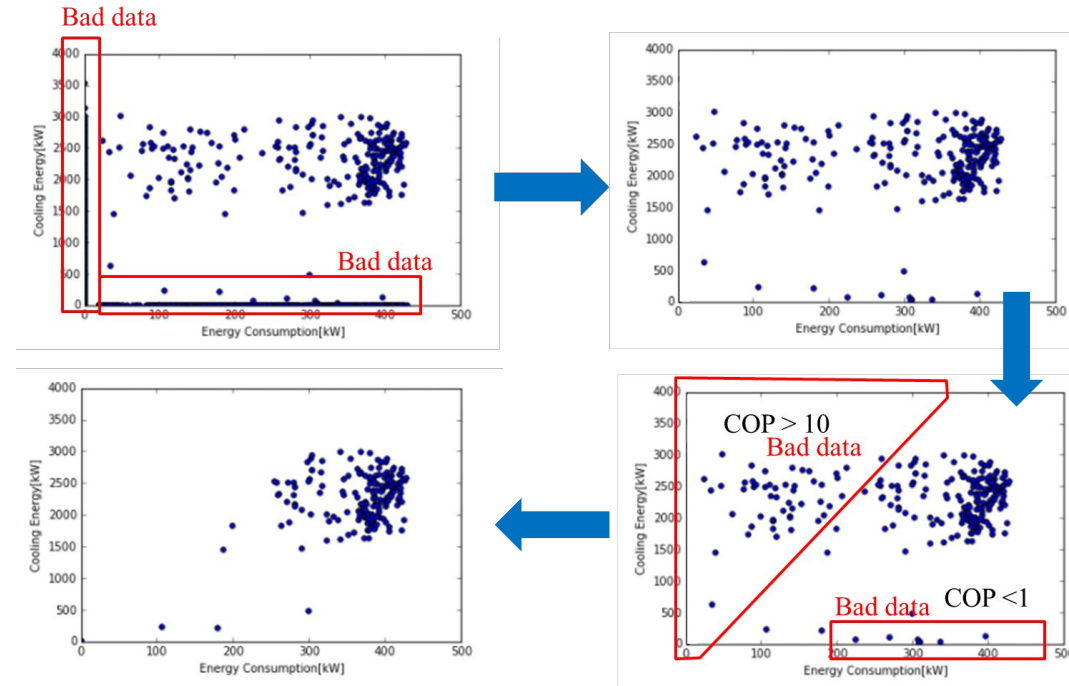Mr. Felix Chan | Climate & Sustainability

Felix.chan@arup.com

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Data Driven Design – "From Data to Knowledge"

Data-driven approach could be able to identify trends over time which can inform effective practices, aware of issues, and illuminate possible innovations or solutions.
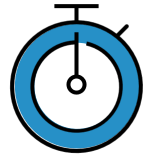
Challenges

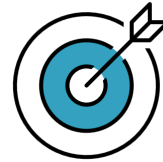The number of useful data drop from 2651 to 179 *(6% of original data)*

Data Quality Analysis Framework
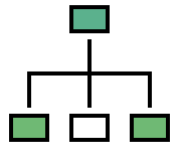
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Completeness

Timeliness

Measurement Certainty

Data Provenance

Noisiness

Data Structure

Comparability

Uniqueness

Granularity

Reference from both international and local guidelines regarding data quality assessment and building performance analysis

AI-assisted Building Operation

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The Neuron System analyzes the real-time data received from various building systems and provides the insight & operation assistance to building operators to take immediate action

- ✓ Abnormal Data Detection
- ✓ HVAC System Optimization
- ✓ Operation Strategy Suggestion
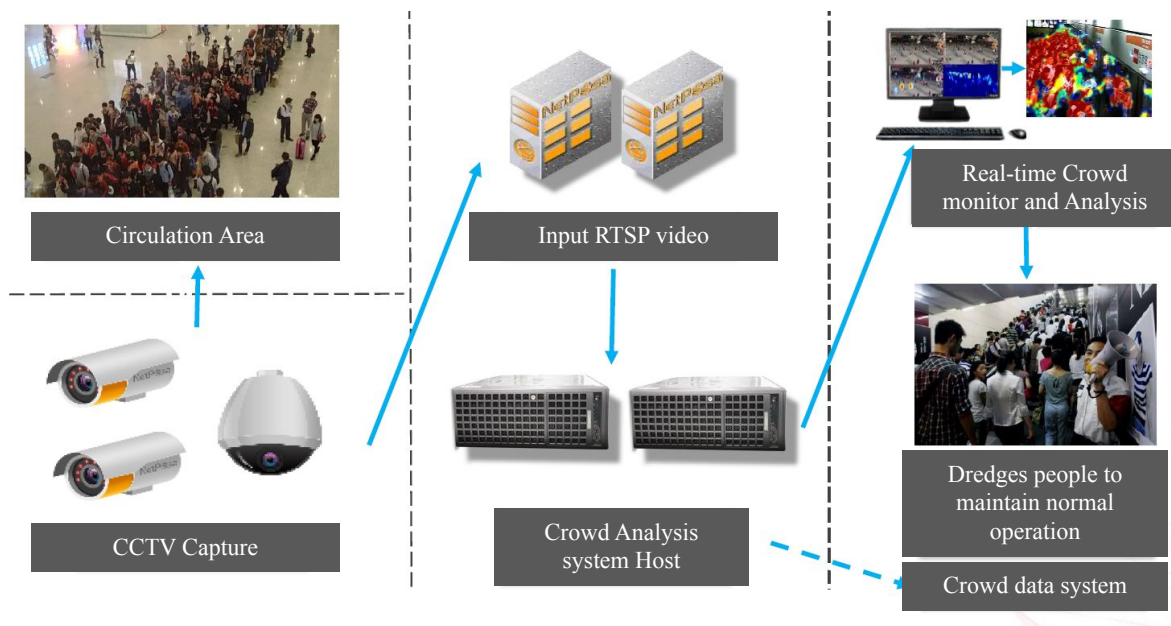- ✓ Emergency Response
- ✓ Asset Management

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Machine Learning for HVAC Plant Optimisation

Through analyzing historical data, mechanic learning models uncover hidden patterns and give estimation on energy usage for better planning in advance.

- Chiller Plant performance evaluation

- Free Cooling Prediction

- Operation strategy suggestion
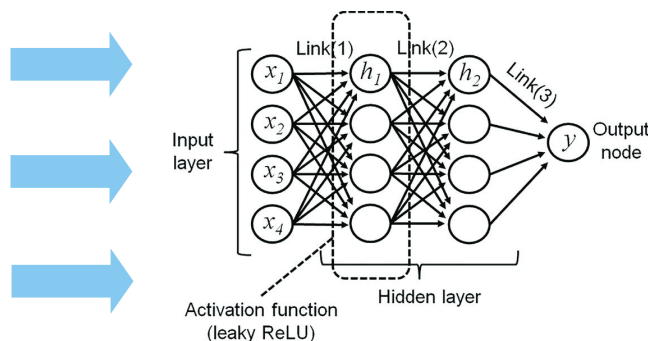
- Energy Demand Forecasting

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Neuron

Machine Learning for Air Side AHU Analysis

Circulation Area

CCTV Capture

Input RTSP video

Crowd Analysis system Host

Real-time Crowd monitor and Analysis

Dredges people to maintain normal operation

Crowd data system

People Counting Analysis ☆

BIM-FM | Energy Home | Chiller Plant Analysis | AHU Analysis | Equipment List

Morning Peak	Evening Peak	Coming Today
08:40	18:20	26

Floor with Most People	Lobby with Most People	Leaving Today
47/F	15/F	4

People Counting Data: 6500

Video Analytics Results on Footfall Data in One Day

Total | In | Out | Lift Lobby

Input

Neuron Network Forecast

Output

Optimization

- Historical Data
- Indoor Air Quality
- People Counting
- Outdoor Temperature
- Occupancy Schedule
- Operation Mode

Link(1) Link(2) Link(3)

Input layer x_1 x_2 x_3 x_4 h_1 h_2 Output node y

Activation function (leaky ReLU) Hidden layer

- Area Cooling Load
- CO_2 Forecast

- Fan Speed
- Fresh Air Intake
- AHU Schedule

Digital Twins - BIM Integration for Building LCA Management

3D BIM is integrated with real-time data captured from building management systems and HVAC systems using
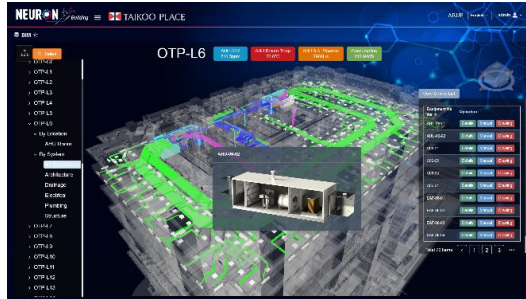open protocols including BACnet and Modbus.

✅ Visualized statistics

✅ Interactive & responsive dashboards

✅ Various model display effects
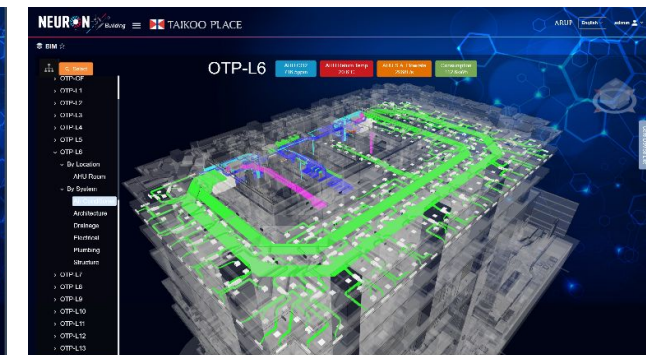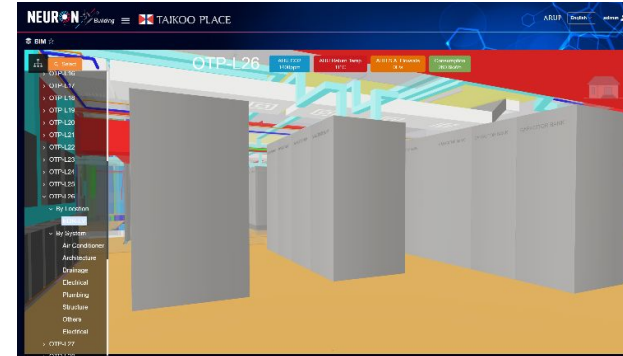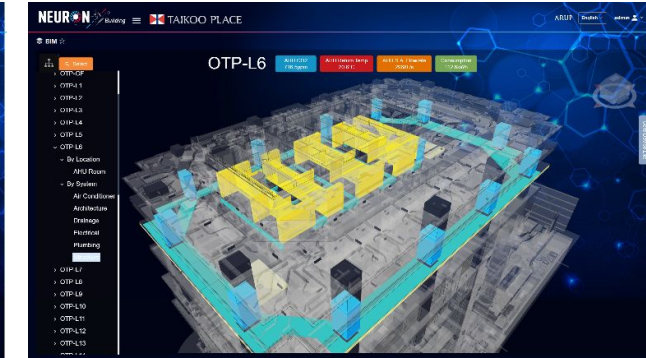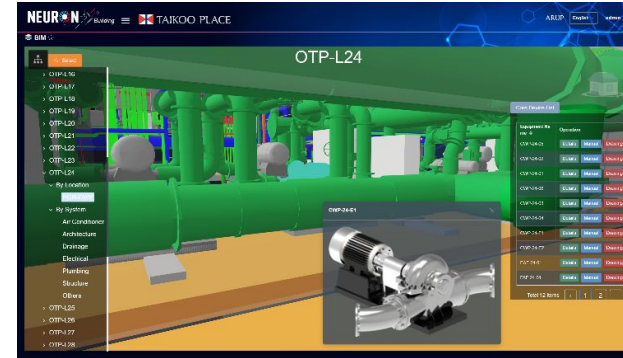
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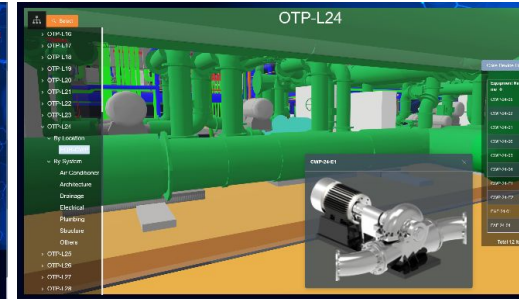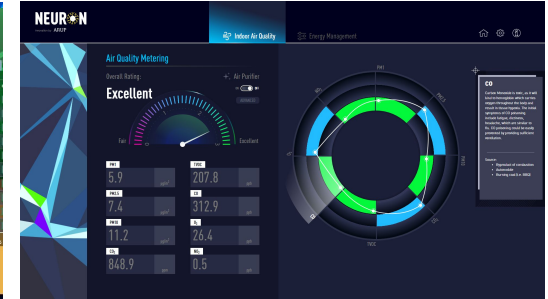# Landscape

BIM Integration

Asset Management

Predictive Maintenance

Health monitoring and control

Heatmap Analysis

Energy Management
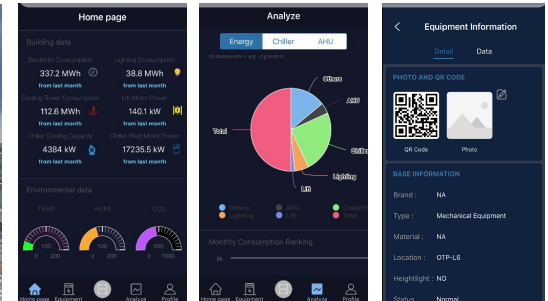

AI Chiller Plant Optimization

AI Video Analytics

AHU Air Side Optimization
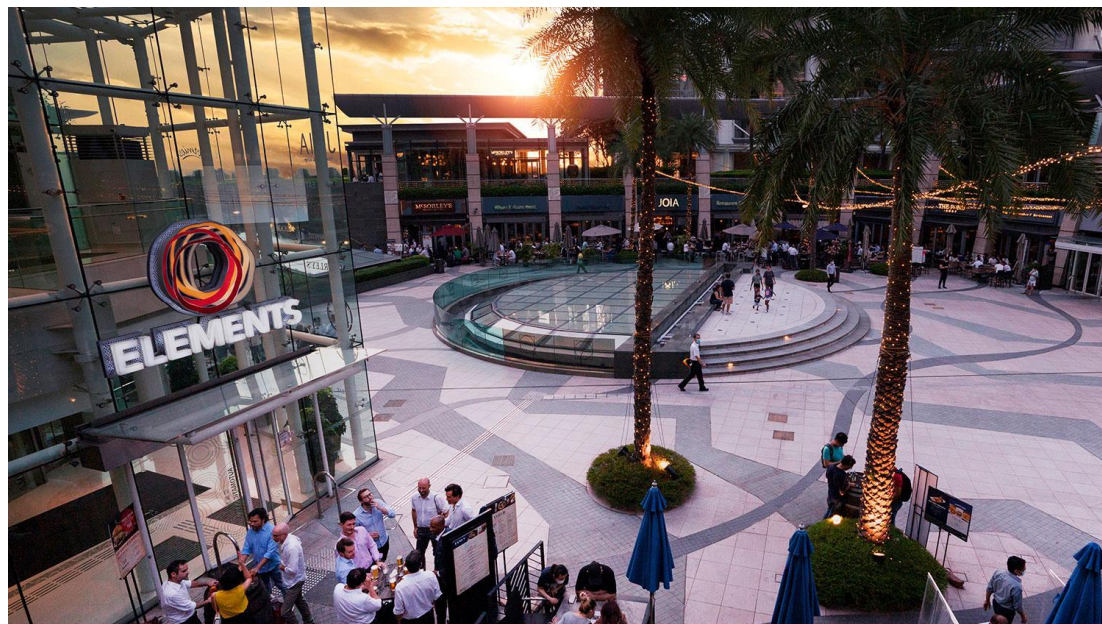

Sustainability Benchmarking

GIS Integration

Chatbot

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Energy Management and Digitalization

AI Energy Efficiency Enhancement at ELEMENTS

Elements, MTRC

First project in EA won ASHRAE Technology Awards and Award of Engineering Excellence in 2025

From AI predictive HVAC system control and data analysis, to improving customer experience and wellness

Arup acts as a building energy expertise to conduct energy audit, and retro commissioning and retro fitting for improving air-conditioning and mechanical ventilation (ACMV system) operation performance. This Project achieved **10% operation energy saving** in ACMV system after AI solution implementation (payback within 1 year) and 15% future energy saving after ACMV system is upgraded.

This project is also the pilot for Arup's own data quality assessment framework, where real-life operational and environmental data is analyzed and improved, taking data-driven decision making to whole new level.

Recognition

Winner of ASHRAE Engineering Excellence Award (Global) 2025
Winner of ASHRAE Technology Award Society Level 2025

Benefits

Reduced energy consumption

Data driven decision making

Cost savings

Future Proofing

Reduced GHG emissions

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