iLab | @HKURBANlabs the smart construction lab

MiC Trio:

Digitalizing Modular Integrated Construction from Factory to Foundation



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Our Partners

香港大學 THE UNIVERSITY OF HONG KONG

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Building Technology Research Institute 香港建築科技研究院
Wholly Owned by the Financial Secretary Incorporated

Architectural Services Department

Hong Kong Housing Authority

Our Products

e-InStar 智驗寶

e-TranStar 智運寶

e-InstaStar 智裝寶

CONTENTS

About Team 01

Vision, Mission & Core Values 01
Introduction to iLab@HKU 02
Message from the Technical Director 03
The Development Team 04

e-InStar 05

Technology R&D 05
The Product 06
Industrial Applications 07–08

e-TranStar 09

Technology R&D 09
The Product 10
Industrial Applications 11

e-InstalStar 12

Technology R&D 12
The Product 13
Industrial Applications 14–15

About Future 16

Awards 16
Community Impacts 17
Future Vision 18

Vision

Digitalization for a better built world

Mission

Deliver end-to-end blockchain solutions that connect production, logistics, and installation across the Modular Integrated Construction value chain.



Core values

Transparency | Accuracy | Productivity | Trust | Innovation | Society

About iLab



iLab is affiliated to the Faculty of Architecture (FoA) and housed in Knowles Building at the University of Hong Kong (HKU). iLab is established as an urban big data lab to take the opportunities and challenges as instigated by the global visions of Smart City and Industry 4.0. It has made a significant break-through in modernizing the construction industry in Hong Kong and beyond. It is devoted to three things:

- World-leading R&D in BIM, smart construction, and Proptech;
- Nurturing future leaders of construction digital transformation; and
- Meeting the industry's immediate and future needs.

iLab is now developing three clear research lines for construction digital transformation:

(a) BIM and digital twins (DT) for architecture, engineering, and construction (AEC). We advanced the applications of blockchain, AI, and IoT technologies in the fields of construction management, generative design, cost surveying, and restoration of heritage buildings.

(b) PropTech for smart construction. We developed a strong track record of devising auto-ID, BIM, blockchain, computer vision, and other award-winning Proptech for managing logistics and supply chain (LSCM) in public housing and MIC projects.

(c) Big data and robotics for construction waste management (CWM). We deployed big data algorithms to identify illegal dumping, and developed 'AI inspector' for gauging admissible construction and demolition waste at government waste disposal facilities.

Professors	Post-doctoral Fellows	PhD students/ Research Assistants	Publications	Patents
6	5	50+	300+	6



Message from the Technical Director

Lu, Wilson W.S.

BSc; MSc; PhD HK; MCIOB; MASCE

Head of Department and Chair Professor (Digital Construction)

Director of iLab

Department of Real Estate and Construction

Faculty of Architecture

The University of Hong Kong

Modular Integrated Construction (MiC) has become one of the most promising ways to deliver quality housing faster and safer. Yet the true challenge lies not only in the modules themselves, but in the invisible journey they travel — from factory production across the border, through logistics, to precise on-site installation.

When quality inspection, real-time tracking and installation accuracy cannot be guaranteed, the entire promise of MiC is at risk.

This is why we developed MiC Trio.

Through three tightly integrated, blockchain-enabled applications — e-InStar, e-TranStar and e-InstalStar — we have created an end-to-end digital ecosystem that brings full transparency, accuracy and trust to every stage of the MiC supply chain. What was once difficult to monitor remotely can now be verified in real time, with immutable records that protect all stakeholders.

MiC Trio has already been successfully applied in public housing and student residence projects in Hong Kong. More importantly, it demonstrates that digital innovation can directly contribute to solving pressing societal needs — delivering better homes, reducing waste, and building safer cities.

Our goal remains clear: to turn advanced technology into practical solutions that serve people and communities.

I am proud of what the iLab team, together with our government and industry partners, has achieved. We look forward to sharing MiC Trio with the world and continuing this journey of digital transformation for a better built environment.

Meet Our Team



Dr. Ziyu Peng

Post-doctoral Fellow

Dr. Ziyu Peng is a Post-doctoral Fellow at The University of Hong Kong. He obtained his PhD in Construction Informatics from HKU (2020–2024), an MSc from University College London, and a BEng from Tongji University. He led the end-to-end project management of the MiC Trio systems (e-InStar, e-TranStar and e-InstalStar) for the Light Public Housing projects. His work covered system architecture, backend development, mobile applications, IoT and RFID integration, BIM linkage, and blockchain-based data anchoring. He has also contributed to RGC-funded research.



Mr. Hongda An

PhD Student

Mr. Hongda An is a PhD Student at The University of Hong Kong. He obtained his MSc in Digital Engineering Management from University College London and a BEng from Beijing University of Posts and Telecommunications. He developed and extended the e-InStar and e-InstalStar systems for the Light Public Housing projects in Tuen Mun and Ma On Shan, as well as the Tak Tin Street Public Housing project. His work covered backend APis, web platforms, mobile applications, bulk inspection and acceptance, module–material matching, progress visualization, BIM integration, and blockchain data-anchoring with Solidity smart contracts and IPFS.



Mr. Yuanben Zou

PhD Student

Mr. Yuanben Zou is a PhD Student at The University of Hong Kong. He obtained his MSc in Computer Engineering from the National University of Singapore and a BEng from Beijing University of Posts and Telecommunications. He contributed to the development of the InStar system for the Tuen Mun Light Public Housing project and led key advancements in the e-TranStar systems for the Ma On Shan and Tak Tin Street projects. His work focused on next-generation i-Core IoT solutions, RFID integration, real-time tracking, data visualization, blockchain storage, and transport safety alerts.



Mr. Yaoliang Zhuang

PhD Student

Mr. Yaoliang Zhuang is a PhD student at The University of Hong Kong. He has contributed to several major public housing projects, including the Light Public Housing developments in Tuen Mun and Ma On Shan, and the Tak Tin Street Public Housing project. He developed BIM models using Revit and Navisworks, deployed IoT-based real-time sensor networks for environmental monitoring, designed scheduling algorithms reinforced by machine learning techniques, carried out structural safety monitoring, and built autonomous agents to support on-site construction coordination.

e-InStar

Blockchain-enabled MiC Quality Inspection Platform



01

Blockchain Foundation

- Real-time dashboard powered by a private PoA blockchain.
- Approvals, uploads, inspections, and reports are recorded on-chain.
- Each action is traceable and tamper-resistant.

02

Mobile App and Web Platform Access

- Mobile and web users submit records directly to the blockchain workflow.
- Smart contracts verify approvals, photos, and reports.
- Every action creates an auditable blockchain record.

03

Real-Time Data Capture

- Inspection records, photos, and reports are captured instantly.
- Files are stored via IPFS, with CIDs anchored on-chain.
- Confirmed records cannot be altered.

04

Remote Quality Monitoring

- Remote teams track quality status and evidence in real time.
- Blockchain ensures transparency, auditability, and data integrity.
- Key breakthroughs: on-chain approvals, IPFS evidence, immutable records.

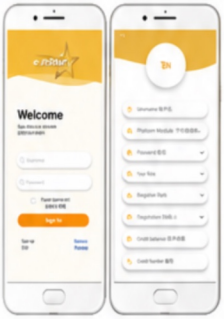
The Product (e-InStar)

A blockchain-enabled platform for factory inspection, approval, reporting, and remote quality monitoring.

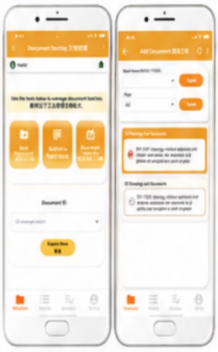
Core Functions

- Digital inspection records
- Mobile and web submission
- Photo and report upload
- Approval workflow
- Real-time progress tracking
- Automated reports
- Material and drawing document traceability by module
- Remote quality audit

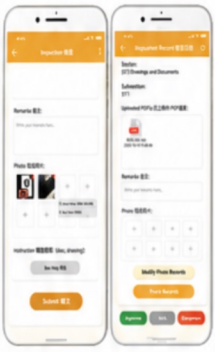
User Interface Highlights



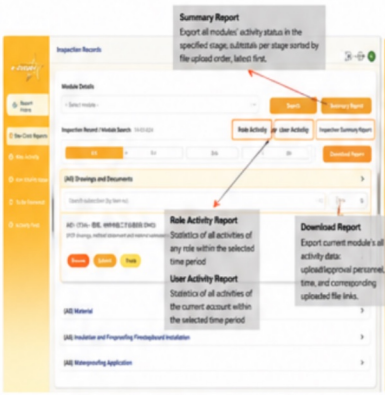
1. Login / Register / Fingerprint Authentication



2. Module/Batch/Document ID creation



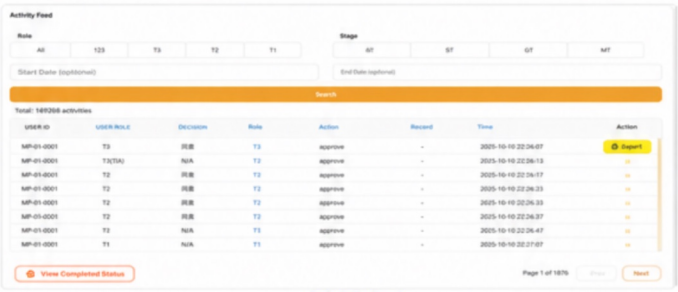
3. Mobile Inspection / File Upload



4. Automated Inspection Reports



5. Production Overview Dashboard



6. Activity Feed

Blockchain Record

- Records are written on-chain.
- IPFS CIDs connect evidence with blockchain records.
- Transactions trace user, module, time, and action.


```
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  decisionMaking: 'n/a',
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}
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Digital Inspection Workflow



Industrial Applications (e-InStar)



HKU Wong Chuk Hang Student Residence

956 MiC modules



HKU High West Student Residence

1,140 MiC modules



HKHA Tak Tin Street

1,023 MiC modules



ArchSD Light Public Housing – Tuen Mun

2,892 MiC modules



ArchSD Light Public Housing – Ma On Shan

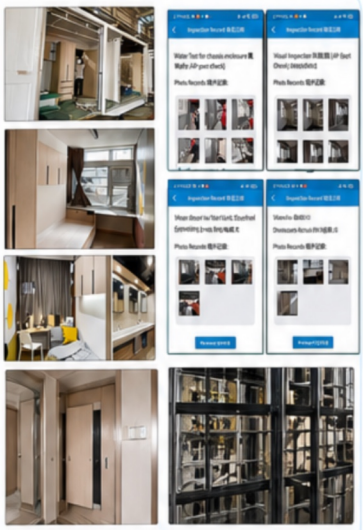
1,164 MiC modules

Proven Performance & Industry Impact

- **7,175** MiC modules deployed across real projects
- **0%** packet loss rate during system operation
- **30 req/s** peak system throughput
- Positive user feedback on process control and material traceability
- Scalable blockchain e-inspection model for MiC quality management

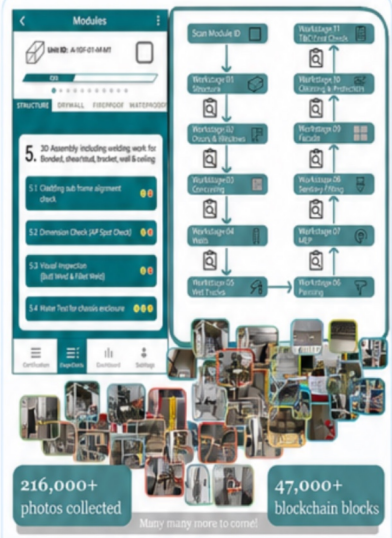
Industrial Applications (e-InStar)

Real project photos from deployed MiC quality inspection workflows



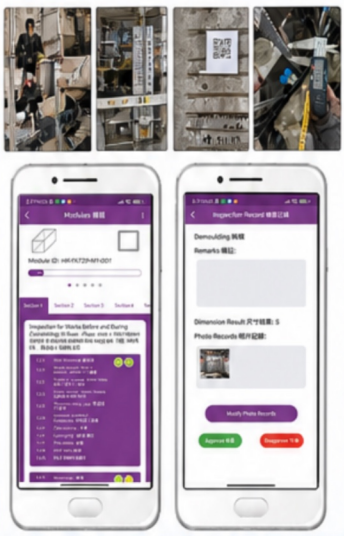
HKU Wong Chuk Hang Student Residence

956 MiC modules



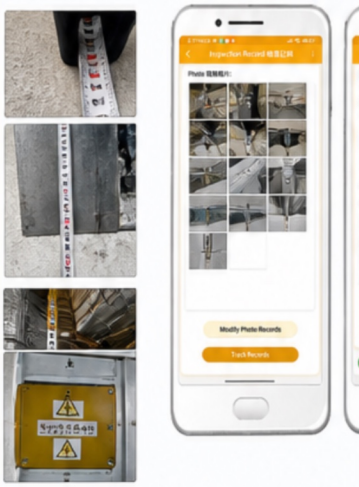
HKU High West Student Residence

1,140 MiC modules



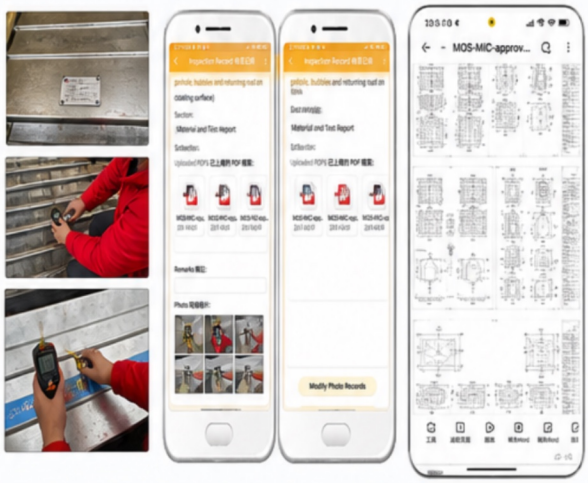
HKHA Tak Tin Street

1,023 MiC modules



ArchSD Light Public Housing - Tuen Mun

2,892 MiC modules



ArchSD Light Public Housing - Ma On Shan

1,164 MiC modules

e-TranStar

Smart MiC Logistics Platform

e-TranStar 智運寶



01

i-Core Sensor Suite

- Collects GPS, vibration, temperature, and humidity data
- Supports RFID module identity verification
- Enables real-time condition monitoring during transportation

02

Blockchain + Logistics Intelligence

- Links module ID, RFID tag, transport data, and handover records
- Creates tamper-resistant logistics records
- Improves transparency across factory, driver, and site teams

03

Real-Time Tracking & ETA Prediction

- Tracks module location and journey status in real time
- Predicts ETA using live telemetry and route data
- Supports alerts, geofencing, and dynamic scheduling

04

Agentic AI for Just-in-Time Delivery

- Coordinates fleet routes and delivery priorities
- Provides hold/go recommendations for site readiness
- Enables Just-in-Time delivery with reduced waiting and congestion

The Product (e-TranStar)

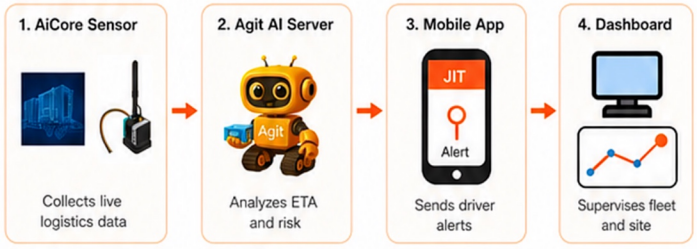
e-TranStar 智運寶

AiCore (Sensor)



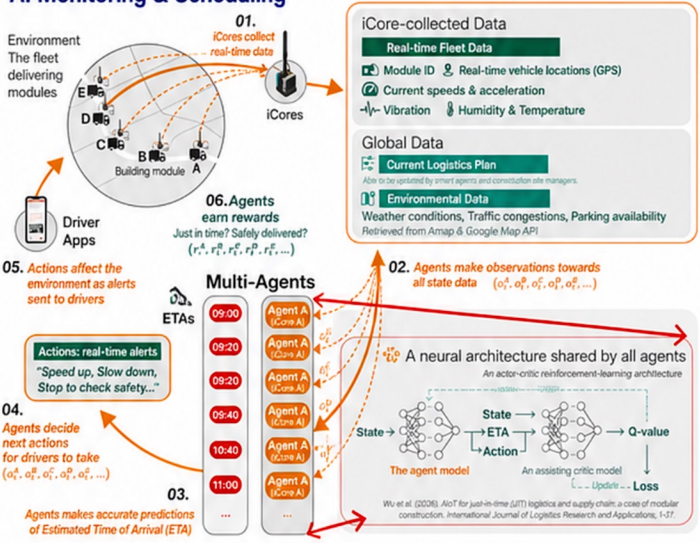
- Real-time GPS and condition sensing
- Vibration, temperature, and humidity monitoring
- Module-level logistics traceability

How It Works



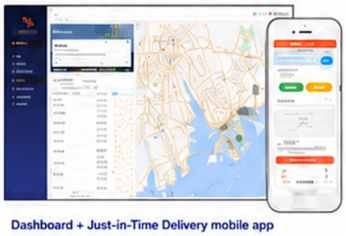
- AiCore collects logistics and condition data
- Agit AI analyzes risks and delivery coordination
- Dashboard supports fleet and site supervision

AI Monitoring & Scheduling



- Multi-agent AI analyzes fleet and site conditions
- ETA prediction supports delivery planning
- Alerts help drivers respond to transport risks

Mobile App & Dashboard Interface



Dashboard + Just-in-Time Delivery mobile app



Quality Monitoring dashboard interface

- Real-time quality monitoring, route tracking, and delivery status
- Driver notifications for Just-in-Time delivery and on-site coordination
- Unified dashboard for managers to review alerts, ETA, and module progress

Industrial Applications (e-TranStar)

Anderson Road Quarry Site

JIT trial with i-Core field deployment and cross-border MiC transport monitoring.





HKHA Tak Tin Street

Public housing application for on-site delivery coordination and quality assurance.





ArchSD Ma On Shan Project

Module delivery, on-site tracking, and transport condition monitoring.






e-InstalStar

On-site MiC Installation Inspection Platform



01



On-site Installation Records & Inspection

- Creates digital records for on-site MiC installation
- Captures photos, PDFs, timestamps, and inspection evidence
- Supports role-based approval, rework tracking, and completion status

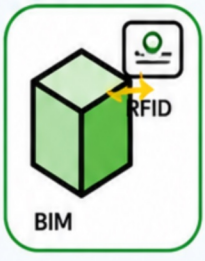
02



Hoisting Path Recording

- Records module lifting and installation progress
- Links hoisting activities with module ID and site records
- Supports traceable installation handover

03



BIM + RFID Integration Algorithm

- Links RFID module identity with BIM model IDs
- Connects installation records to BIM, document, and batch data
- Enables blockchain-backed traceability for later operation and maintenance

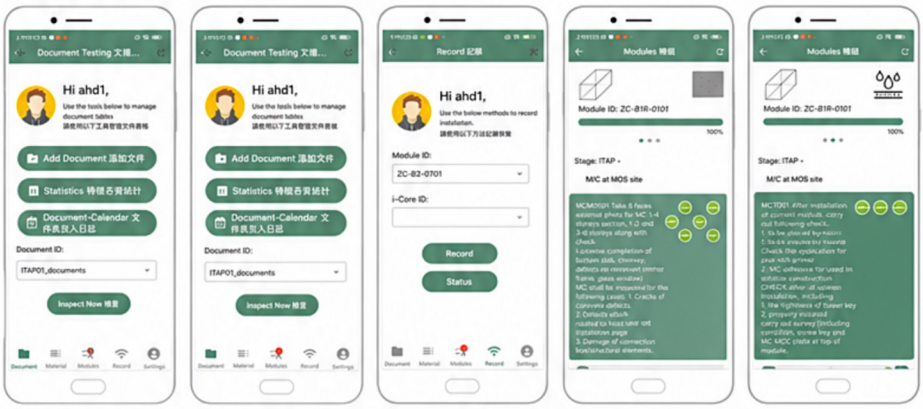
The Product (e-InstalStar)

An on-site MiC installation support platform that connects mobile inspection, i-Core RFID verification, hoisting trajectory tracking, and BIM-based progress monitoring.

Core Functions

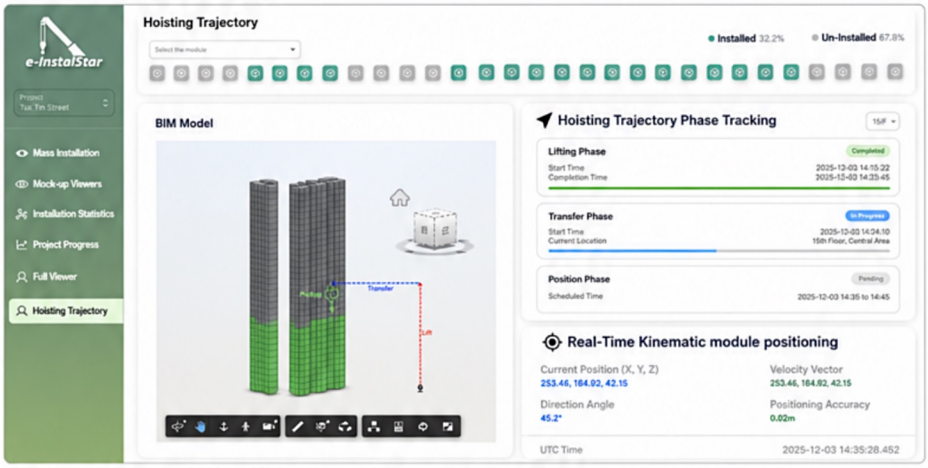
- Mobile app and Web platform for on-site inspection and records
- RFID arrival verification for planned modules
- Installation record query and approval workflow
- BIM dashboard for progress and module status
- Hoisting trajectory mapping with i-Core data
- Position comparison between planned and actual modules

Mobile Inspection



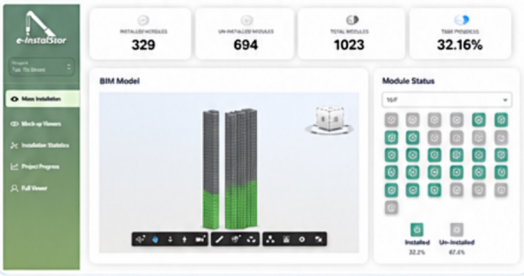
Record module ID and i-Core ID on site • Capture inspection status, photos, and remarks • Submit installation records through the mobile app

BIM / Hoisting Trajectory



BIM / Hoisting Trajectory dashboard for progress monitoring and trajectory verification.

BIM Mass Installation



i-Core / RFID Device



Site Hoisting Evidence

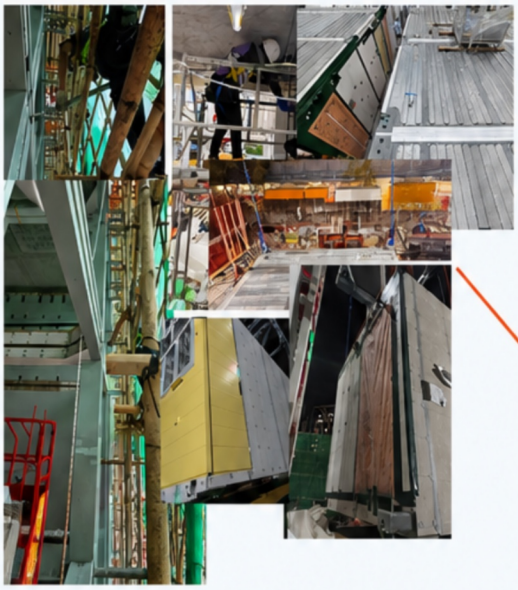


e-InstalStar Operation Workflow

Scan RFID → Verify Module → Mobile Inspection → Attach i-Core → Hoist Module → Record Trajectory → Compare with BIM → Confirm Installation

Industrial Applications (e-InstalStar)

Tak Tin Street





Digital File Records

Site photos, PDFs, and remarks are recorded in the mobile app

Records are traceable by module and time



i-Core sensor



Dynamic digital twin



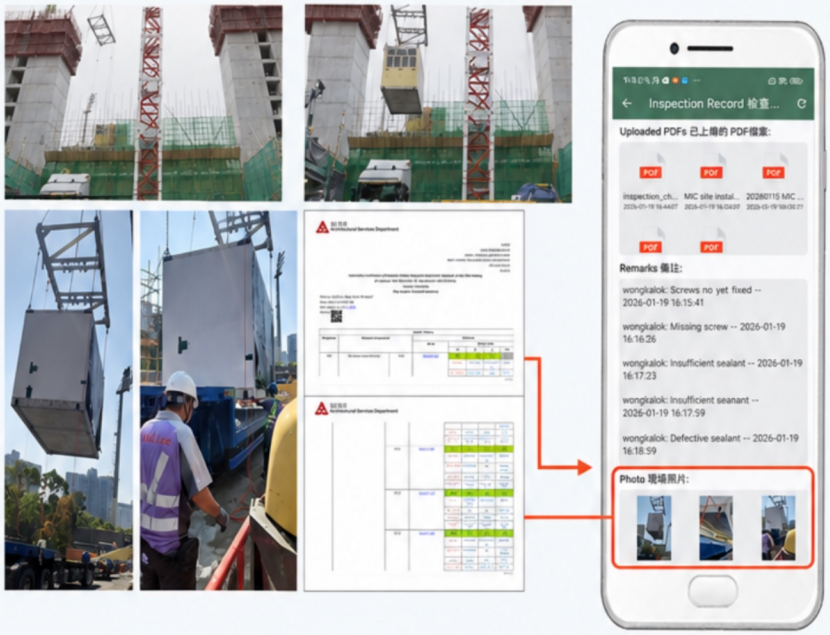
BIM / Hoisting Trajectory

i-Core records module movement during hoisting

BIM dashboard shows installation status by color

Industrial Applications (e-InstalStar)

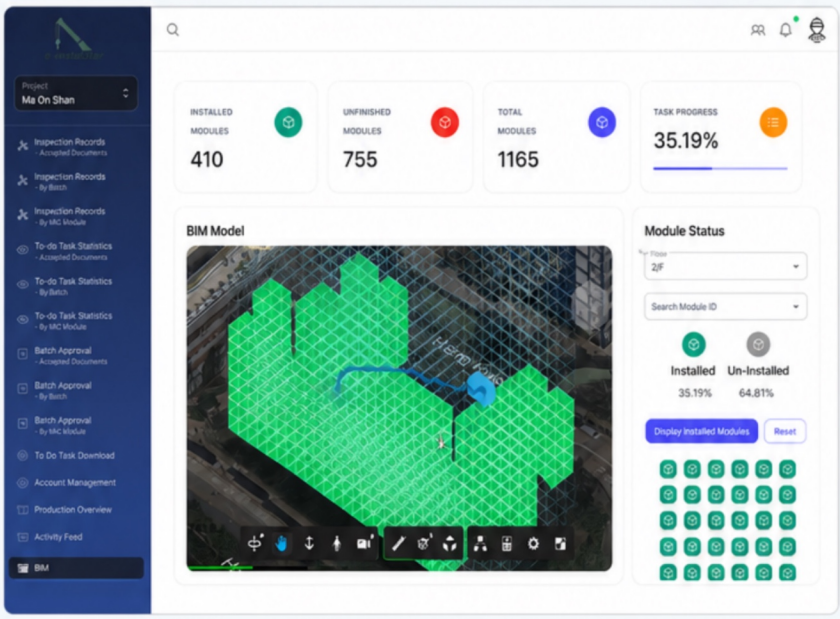
Ma On Shan



Digital File Records

Hoisting photos and PDFs are linked to mobile records

Site evidence supports inspection tracking



BIM-based Progress Monitoring

BIM model shows installed and uninstalled modules

Hoisting trajectory supports progress checking

Awards



2026

Gold Medal at the 51st International Exhibition of Inventions Geneva



2025

Hong Kong ICT Smart Mobility Bronze Award and the “Best Use of AI” Award



2023

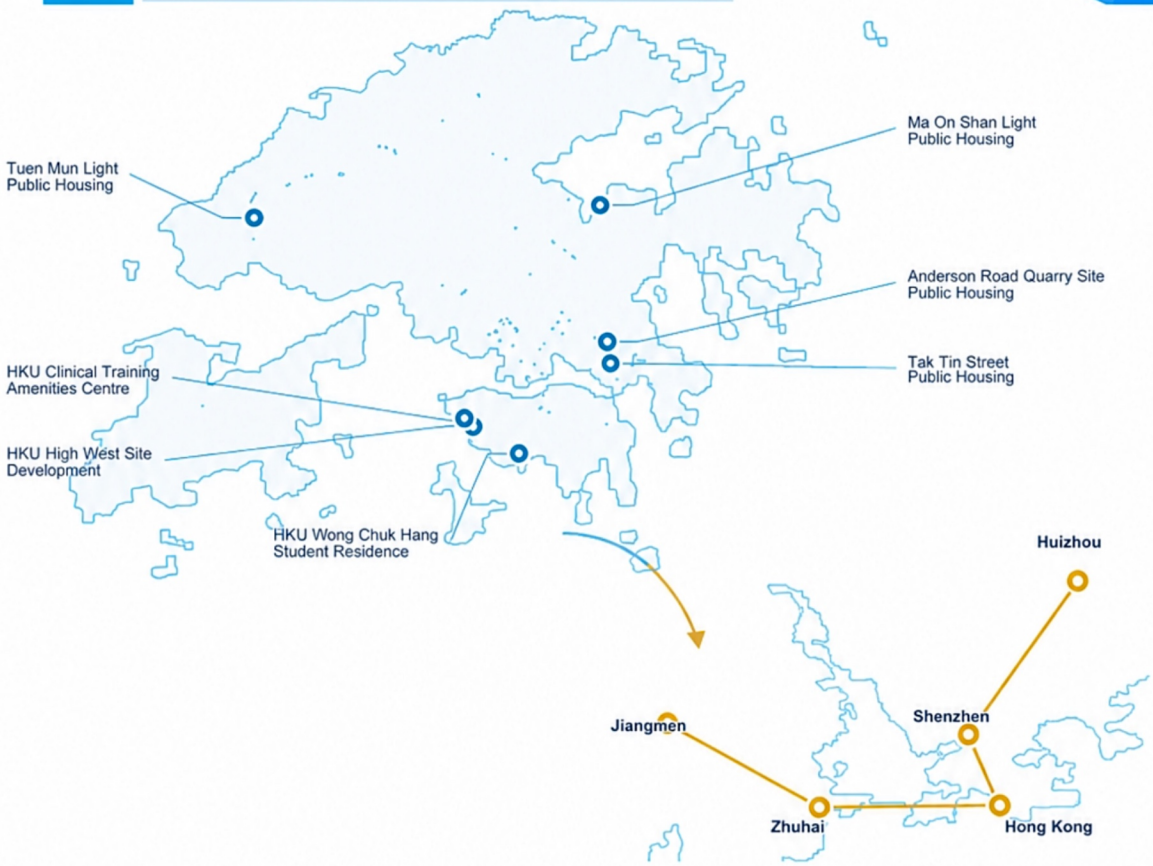
Bronze Medal at the 48th International Exhibition of Inventions Geneva



2022

Hong Kong ICT Smart Logistics Gold Award

Community Impacts





Source: Hong Kong SAR Government, Housing Bureau (2022)



Source: Hong Kong SAR Government, Hong Kong Housing Authority (2019)

Hong Kong is one of the world's densest cities, where many residents still live in inadequate subdivided units while waiting years for public housing. The Government's Light Public Housing initiative, launched to rapidly deliver around 30,000 affordable units and improve living conditions for those most in need, relies heavily on Modular Integrated Construction.

MiC Tio directly supports this vital social program. By providing end-to-end digital monitoring — from factory production in Jiangmen and Huizhou, through logistics hubs in Shenzhen and Zhuhai, to precise on-site installation in Hong Kong — the system makes every stage transparent, traceable and accountable. Real-time quality records, condition tracking and installation verification help accelerate construction, reduce defects and ensure modules meet required standards before residents move in.

Already applied in key projects including the Tuen Mun and Ma On Shan Light Public Housing developments, Tak Tin Street and Anderson Road public housing, as well as several University of Hong Kong residences, MiC Tio strengthens cross-border collaboration within the Greater Bay Area while delivering tangible benefits at home. By safeguarding quality and speeding up delivery of government-provided affordable housing, it contributes to a fairer, more liveable Hong Kong for families who need it most.

Future Vision



Agit
Our next-generation AI helper

Clearer

AI agents will analyze inspection images, sensor data and blockchain records in real time, creating a precise digital twin for every module. Project teams will gain crystal-clear visibility across the entire supply chain, eliminating uncertainty and ensuring higher quality standards for future homes.

Smarter

Predictive AI models will optimize production sequencing, detect risks early and recommend the best logistics and installation decisions. Agentis AI will continuously learn from each project, transforming MiC Trio into an intelligent system that raises productivity, reduces waste and scales modular housing more effectively.

Timelier

Advanced AI will deliver highly accurate, dynamic arrival predictions and just-in-time coordination that adapt instantly to changing conditions. By compressing the journey from factory to site, we will accelerate the delivery of quality public and Light Public Housing, helping more families move into safe, affordable homes sooner.

iLab | @HKURBAN Lab
the smart construction lab



MiC Trio

e-InStar 智驗寶

e-TranStar 智運寶

e-InstalStar 智裝寶

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