

Co-create & Co-innovate Industrial IoT Solutions with Industry

INNOVATE FOR A BETTER TOMORROW



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SCHOOL OF ENGINEERING
think innovation, create possibilities

NYP NANYANG
THE INNOVATIVE POLYTECHNIC

Agenda:

- IIoT Expansion Trends in Singapore
- IIoT and its Values
- Challenges faced by SMEs
- National Centres of Excellence @ SEG
- IIoT Solutions
- Summary

- Established on 1 April 1992
- 15,000 students and 1,300 staff
- 7 Schools
 - School of Business Management
 - School of Chemical & Life Sciences
 - School of Design
 - School of Engineering
 - School of Health Sciences
 - School of Information Technology
 - School of Interactive & Digital Media
- **Mission**
 - Empowering Learners for Work & Life
 - Co-Creating with Industry for Growth & Sustainability
- **Vision**
 - The Innovative Polytechnic
 - A Nexus of Future-ready People, Learners & Industry



Singapore in the Vanguard of a Worldwide IIoT Expansion Trend

05 Jan 2018 - EDB



Source: Emerson

U.S.-based **Emerson Electric Co.** opened its first **Pervasive Sensing Center of Excellence** in the Asia region in Singapore in November 2014, investing US\$10 million. The centre provides support for employee safety assurance and cost and risk reduction by analyzing data gathered from wireless sensors installed in every nook and corner of a manufacturing plant.

In November 2017, Emerson opened a **customer-focused Solutions Center**, offering Emerson's Plantweb™ digital ecosystem, the industry's most comprehensive Industrial IoT automation platform. The Plantweb offering consists of standards-based hardware, software, intelligent devices, and services for securely implementing Industrial IoT-based solutions that can expand digital intelligence to the entire manufacturing enterprise.

Source: Singapore Economic Development Board (EDB)

<https://www.edb.gov.sg/en/news-and-resources/insights/innovation/singapore-in-the-vanguard-of-a-worldwide-iiot-expansion-trend.html>

Singapore RIE 2020 Plan (Jan 2016) - The government is prepared to provide an unprecedented level of support for enhancing the R&D capabilities of universities, government institutions, and private companies and plans to invest S\$3.2 billion during the coming five years to support research in cutting-edge advanced manufacturing technologies such as **IIoT**, robotics, and cloud computing.

Accenture, a leading global IT consulting firm, has also opened its first **IoT research centre** in Singapore in September 2015. The Internet of Things Centre of Excellence conducts technological research related to big data, artificial intelligence, virtual reality, sensors, and other IoT related topics.

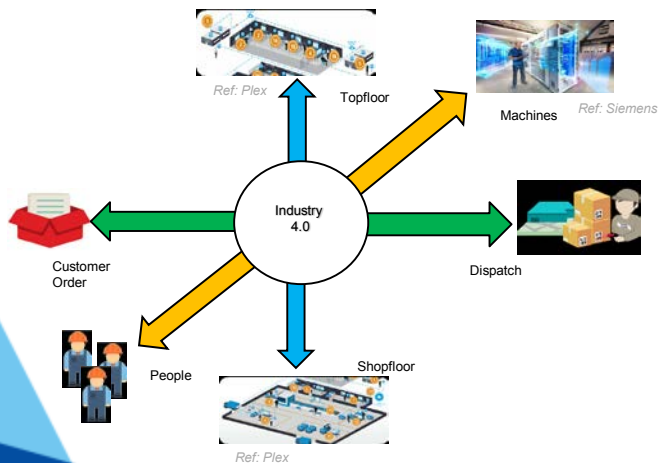
November 2015, **Yokogawa Engineering Asia**, a subsidiary of Yokogawa Electric Corporation, established in Singapore the **Yokogawa Global IIoT Co-Innovation Centre** as a technology development centre for the purpose of utilising big data together with corporate customers and IT companies.

November 2016, **Sumitomo Chemical** started a **global IoT project** in Singapore with support from the EDB, which it will implement in cooperation with Accenture. The company will actively utilise the latest technologies, including digitalization of plant-related operations and visualization and upgrading of global supply chain information.

Industrial Internet of Things (IIoT)

What?

- Not just about devices going digital & smart but about devices get connected & integrated
- Incorporating automation & robotics technology, machine learning, advanced analytics, and M2M communication
- Enhancing & transforming the way raw materials and finished products are procured, processed and distributed



The Values:

- Cost savings, reducing downtime, improving productivity & efficiency
- Provide valuable insight on products behaviour & interaction that can enable preventive maintenance, performance optimisation and prediction of future products
- Enabling rapid decision making and new business models & markets

The Challenges faced by SMEs

Technology perspective:

- Security: a major issue for wide scale adoption of IoT
 - Constant sharing of information between devices and users could occur without the consent of related and authorized personalities
- Heterogeneity of connected Things
 - Interoperability & seamless integration issues
- Complexity of design architecture
 - Complex eco-system to manage efficiently

Source: Frost & Sullivan: IoT – Technology Penetration and Roadmapping

The Challenges faced by SMEs

Business perspective:

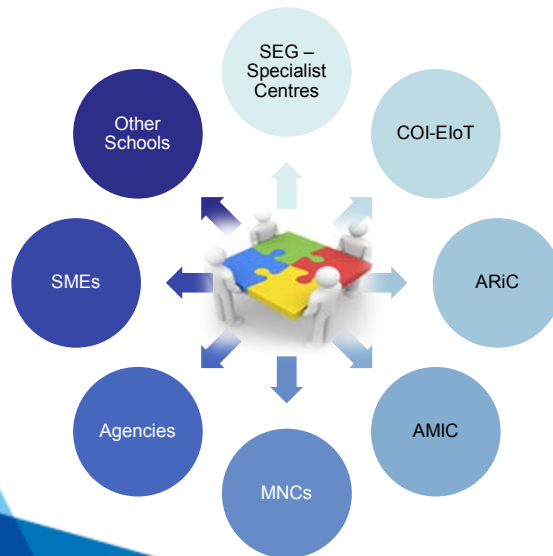
- Intellectual Property
 - Values creation
 - Own IP rights for new business innovations, opportunities & growth
- Rapid Customisation & Deployment
 - Serving diverse customers' expectations
 - Scalability
 - Time to market
- Skills & Knowhow
 - to create, design & develop, integrate, deploy, operate & manage new and changing IIoT solutions/services

National Centre of Excellence



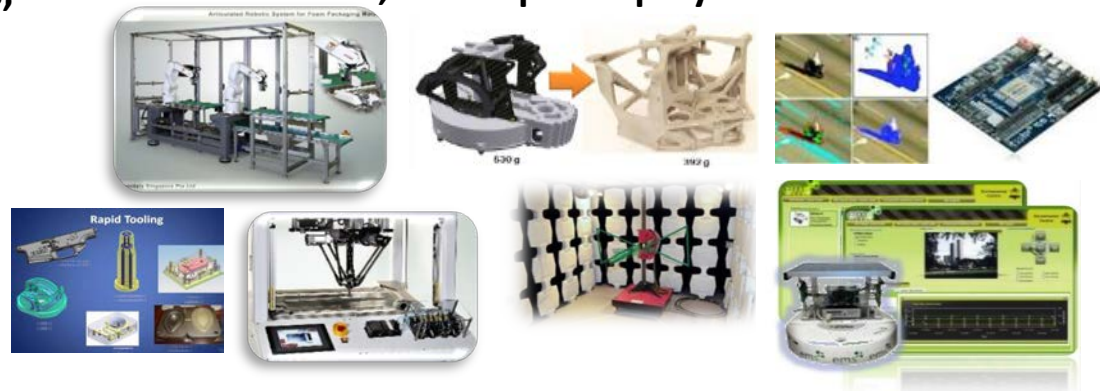
1. Collaborative Ecosystem

- A platform for knowledge exchange
- Connecting innovators, developers, businesses



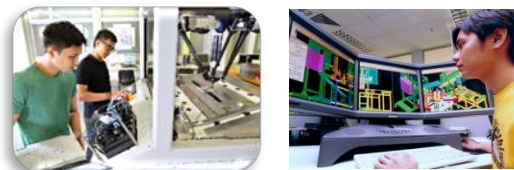
2. Industry Experience

- Knowledge, skills & knowhow to co-create, co-innovate, develop & deploy



3. Manpower Development

- Capabilities development and knowledge transfer



*A key valued
partner of local
enterprises in their
Innovation
Capability &
Capacity Building
and to enable
greater Value
Creation.*

Jointly established by:

SPRING
singapore
Enabling Enterprise

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Industry partners





centre of innovation
ELECTRONICS & IOT

Driving Innovation, Spearheading Growth

Your Partner In Innovation & Growth

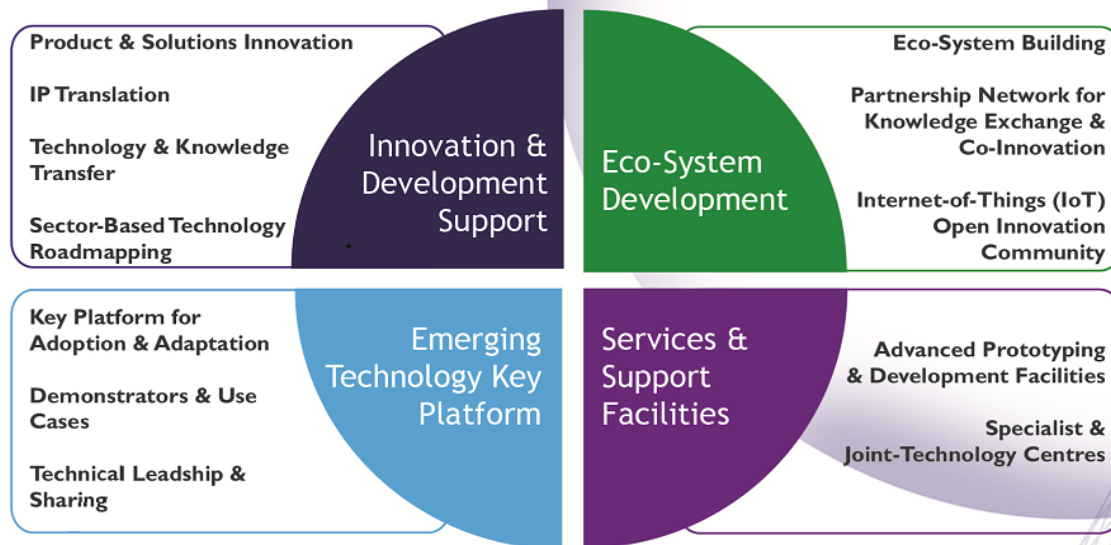
Jointly established by:

SPRING singapore
Enabling Enterprise

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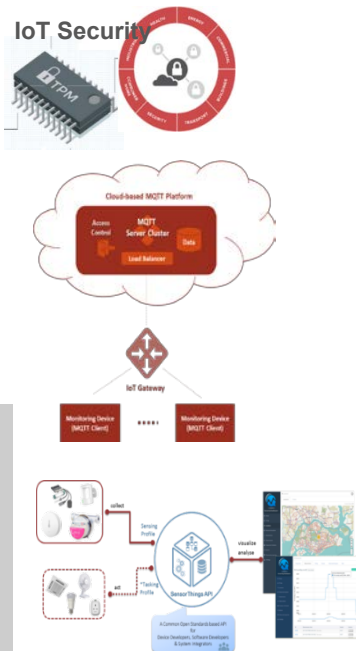
Your partner in innovation & growth



Domain expertise profile and core enabling capabilities

- Embedded Systems
- Wireless Systems
- Imaging & Video Analytics
- Wearable Electronics
- Biomedical Solutions
- IC Design
- IoT Solutions
- Infocomm Solutions
- Communications & Networks
- Computational Intelligence & Data Analytics
- Autonomous & Control Systems

Ecosystem building and partnership network



Representation
in

- iMDA IOT Technical Committee
- iMDA Telecomms Standards Advisory Committee



Internet of Things
O P E N
innovation community



open innovation network that brings together enterprises, technology partners, research and knowledge institutions and relevant industry catalysts to explore, experiment, collaborate and exploit the potential of IoT for new business innovations, opportunities and growth.

Supported by:



- 150 members and growing ... (SMEs, Startups, MNCs)



- Hub for System Integrators (SIs)/Original Equipment Manufacturers (OEMs)/End-User companies to:
 - **co-innovate** Robotics and Automation platforms
 - **test-bed** innovative solutions
 - form **strategic partnership**
- Drive adoption of advanced technologies
- Develop robotics and automation specialists



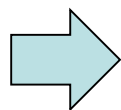
**Design for reliable,
flexible and re-
deployable automation**



**Build for advanced
manufacturing**



**Transformation into
digital manufacturing**



Platform
re-deploy



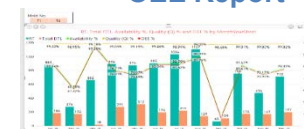
*Build &
Implementation*



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Towards I4.0

OEE Report



Plan & Design





Jointly set-up by:



A national centre for Additive Manufacturing & Design innovation, jointly set up by EDB & NYP:

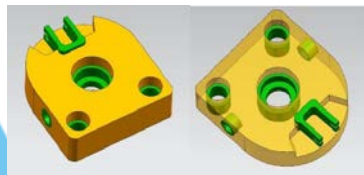
- To develop specialist manpower in AM design and applications
- To drive industry adoption and technology transfer
- To conduct school, community and industry outreach

Key Intents

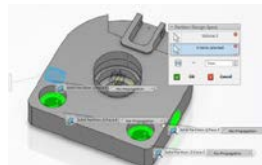


- * Support PET, CET, IPG & applied R&D
- * Customized industry training, seminars & outreach
- * Provide advisory services, project incubation and drive industry adoption & transformation
- * Design for functional AM
- * Design for pre- and post-build optimisation & process automation
- * Direct fixturing & support optimisation
- * In-process parts monitoring, validation & calibration and automation
- * Materials selection & development (smart, multiple & digital material etc.)
- * Optimization of Reactive & Composite material for in-built parts (Titanium, Inconel, Ceramics, Alu etc.)

Design for Additive Manufacturing (DfAM) Optimisation



Original Design
(Automobile Wheel Rear)



Identify Key Functional Parts



Design After Optimisation



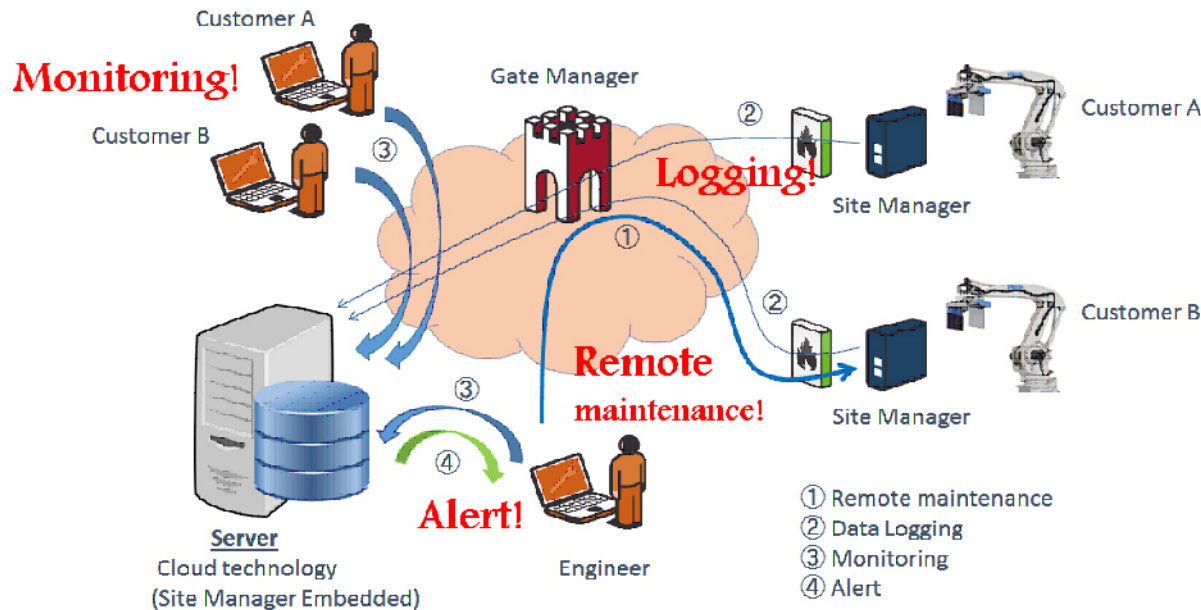
Additive Manufactured (Titanium)

IoT Gateway

Challenges:

- Robot is highly flexible & is configurable according to diverse needs
- Complexity in programming & operating the machine
- Frequent onsite support to its manufacturing customers

Develop gateway to capture robot performance parameters remotely for analysis and predictive maintenance



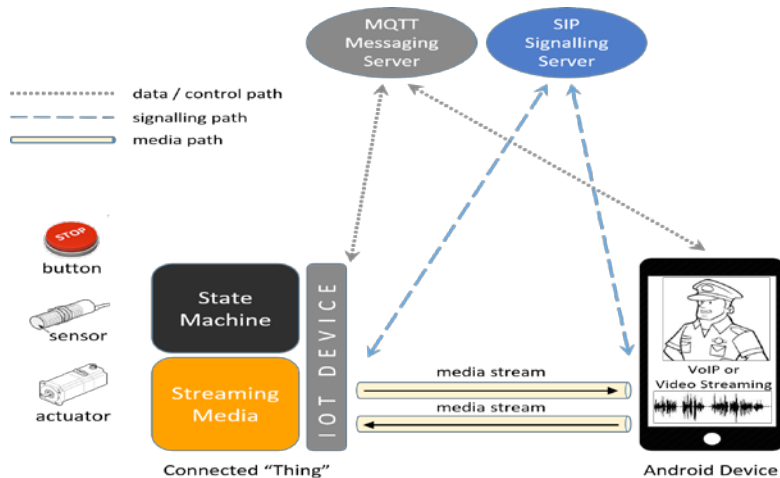
Gateway Functions:

1. Robot Parameters Logging
Robot performance data from multiple sites captured by server
2. Real-time Remote Monitoring, Re-configuration & Maintenance
Remotely monitor the robot performance parameters at various sites, re-configure the robot and analyse for predictive maintenance
3. Alert
Analyse robot performance parameters and alert Engineers for maintenance

SME: A company making palletizing robots for manufacturing.



Streaming Media IoT Platform



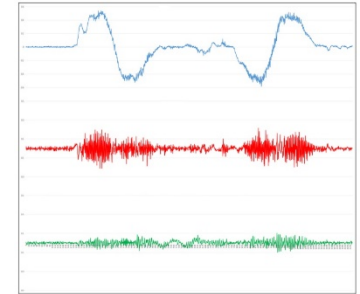
- The advance in IoT not only enables real-time status monitoring and machine control via the Internet, it can also be combined with voice and video communications to formulate a wide range of digital connected solutions for man and machines.
- The versatile IoT platform equips users with real-time visibility to an IoT device and its ambience. A personnel using the connected device can live consult or chat with a remote user who uses a smartphone app.

Real-Time Predictive Machine Health Monitoring

SIGENIC



Sensing and Signal Processing



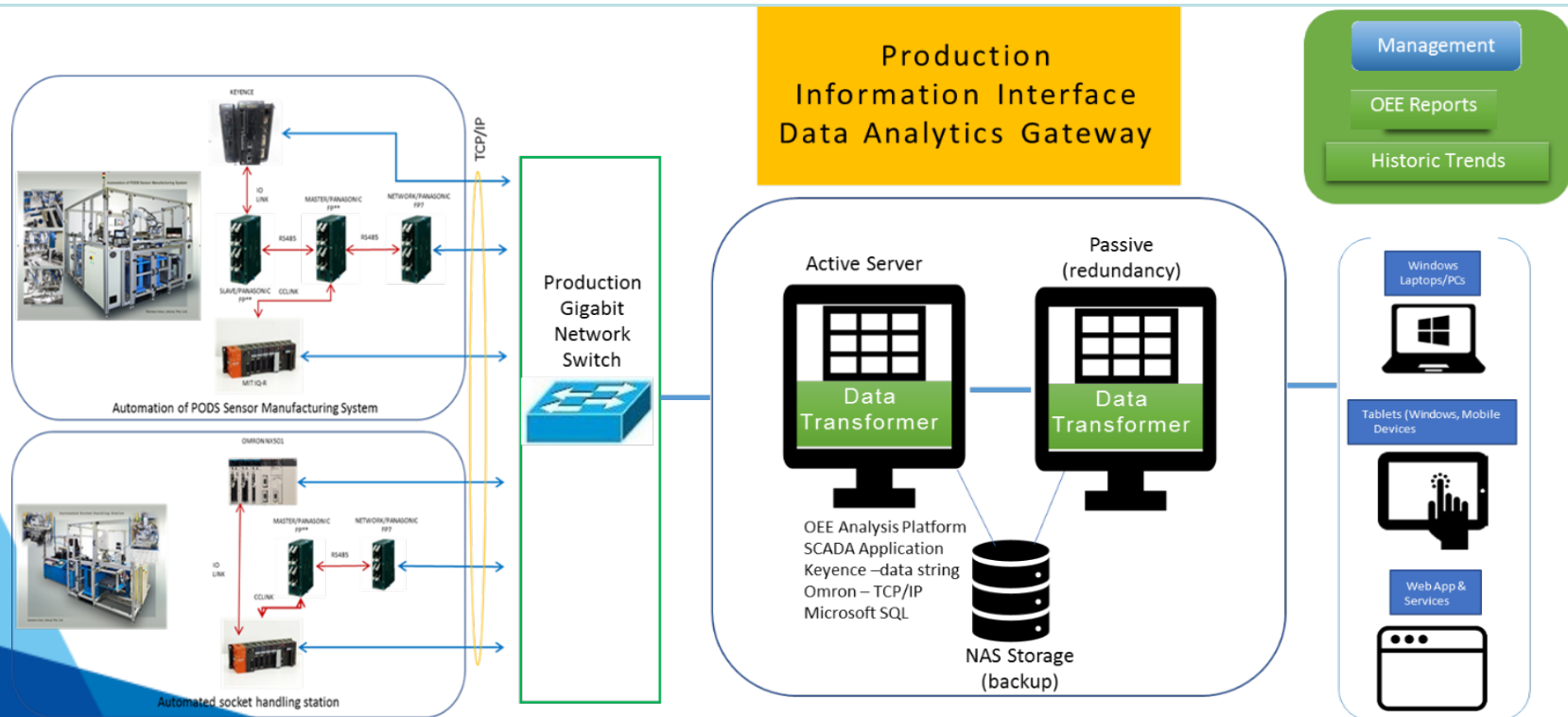
Statistical Analysis

- Power efficient embedded system design to advance the performance of their products in Machine Health Monitoring.
- Equipped with enhanced algorithm and flexibility with different manufacturing platform, the new instrumentation system allows effective and continuous monitoring of real time behaviour of machines and robots.

"The partnership with COI-EIoT has been strategic to us. Working together with the team in embedded design has allowed us to deliver our new machine health monitoring product on time with upgraded features such as real-time analysis and 24x7 monitoring." --- MZ Koh, Director

Shop Floor Monitoring

- Formulate Overall Equipment Effectiveness (OEE) performance of shop floor equipment for improvement of production efficiency and planning.
- Network multiple shop floor equipment in Stacker/De-stacker process, Molding process and Testing process into a private network, to facilitate data exchange between the equipment and the OPC or SCADA server.



Securing Internet of Things (IoT)

Funded by the National Research Foundation Proof-of-Concept (NRF-POC) and Translational (NRF-TRD) Grants

Secured IoT Networks

Novelties:

- Integrates the security management process with the routing algorithm to form a unified routing process.
- Embeds user-definable security parameters using multiple layers information (e.g., application, network, system) into the routing process, and supports user-controllable authentication of intermediate nodes and routing paths.



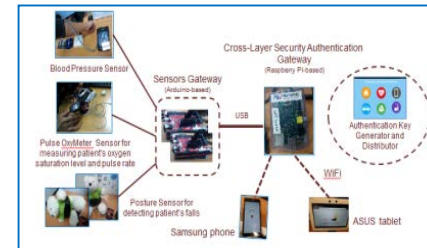
Protected by granted patents:

- Method and System for Secured Service-Oriented Nodes Discovery and Route Determination in Mobile Ad-hoc Network (Singapore Patent No. 172425)
- Method and System for Securing Wireless Systems and Devices (Singapore Patent No. 154827)

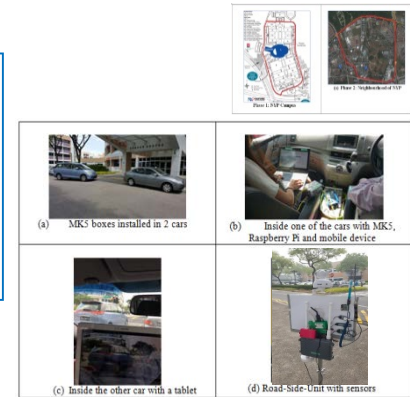
Secured IoT Nodes

Novelties:

- Use of user-definable security parameters in multiple layers (e.g., application, network, system) to generate a unique security key management scheme
- Ability to authenticate without the need of an authentication server



Secured eHealth@Home

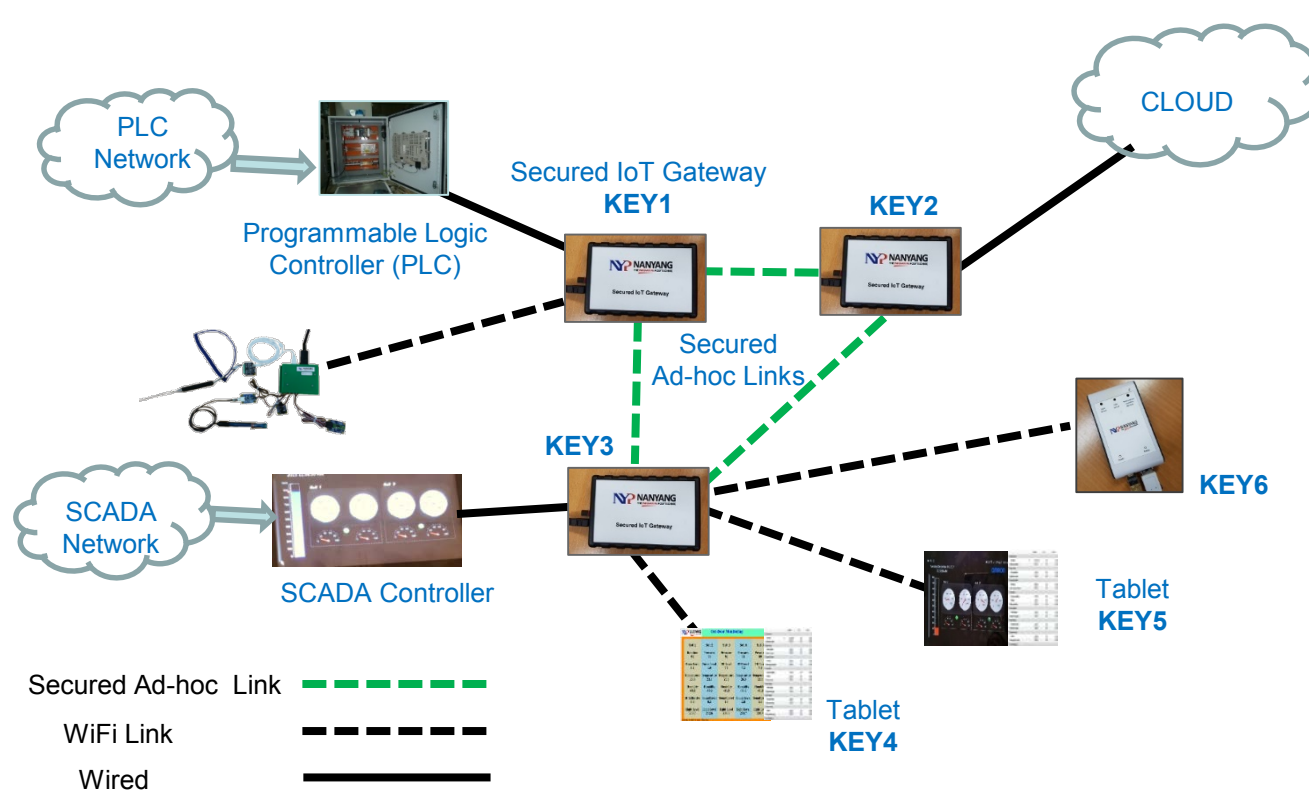


Secured Social and Sensor V2X Network

Applications:

- Manufacturing and automation
- Vehicle-to-Anything (V2X)
- Building management
- Tourism
- Environmental
- Healthcare
- Retail
- Security, etc.

Secured IoT Network and Nodes for Industry Automation



Patents
Granted

Features

- Enable personalised user-definable access control keys
- Enable common security policies across different types of IoT and smart mobile devices
- User-controllable authentication of IoT devices
- Scalable as it can be provided as a software plug-in
- Seamless integration with PLC, SCADA, sensor controllers



Dynamic Real-Time Localisation Engine for IoT

Funded by the Ministry of Education – Translational & Innovation Fund (MOE-TIF) Grant

Patents
Granted

Overview

- Current available localisation methods limit an anchor node (AN) to be stationary. This restriction reduces the operation range of the localisation engine and greatly limits its applications and deployments. The dynamic real-time localisation engine provides reliable relative positions of mobile nodes in a dense IoT network.

Features

- Does not require any stationary reference (anchor) node.
- Does not depend on just one parameter for estimating location
- Has real-time update from neighbouring nodes for improving accuracy without additional hardware
- Can be offered as software plug-in for scalability

Application:

- Locate IoT nodes by mobile user on the go in an advanced manufacturing environment without leverage on network infrastructure



Summary

- Challenges faced by SMEs
 - Security, interoperability, design complexity
 - IP, fast customisation & deployment, skills & knowhow to create & manage
- National Centres of Excellence @ SEG
 - Collaborative ecosystem for knowledge exchange, co-creation & co-innovation
 - People with right knowledge, skills, knowhow & experience
- IIoT solutions with industry

*The mere **formulation of a problem** is often far more essential than its solution, which may be merely a matter of mathematical or experimental skill. To raise new questions, new possibilities, to regard old problems from a new angle requires creative imagination and marks real advances in science.*

- Albert Einstein

Thank you

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