ADULT
LEARNING
SYMPOSIUM

Professional Learning :
A Multi-Disciplinary and Industry
Practice Partnership

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1 November 2018

Supported by

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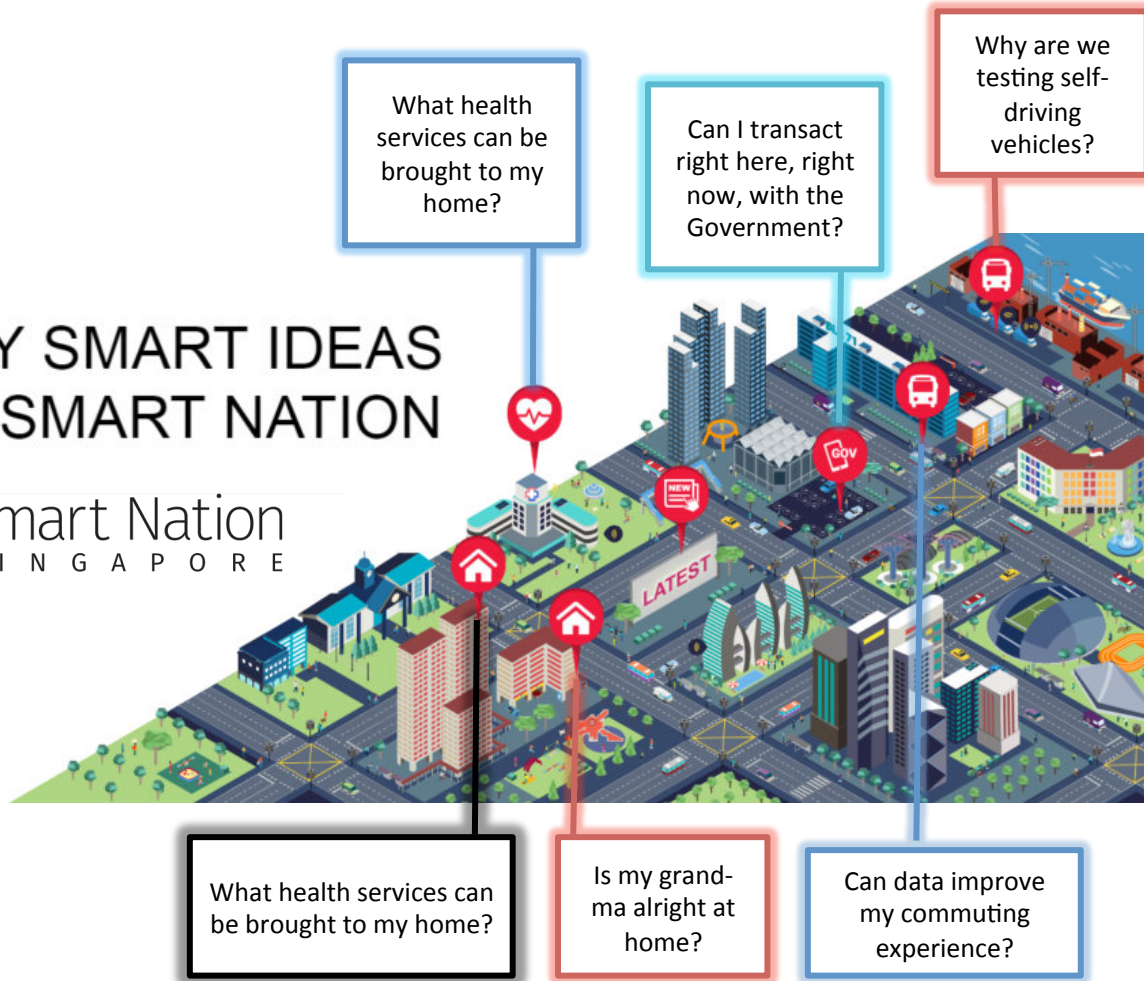INSTITUTE FOR
ADULT LEARNING
SINGAPORE

AN INSTITUTE OF SKILLSfuture SG

What Makes a Smart Nation?

Intended Objectives

- Smart Nation Singapore is underscored by (re-) skilling and promoting the learning of ICT, Engineering skills

- Demand of skills training that responds to :
  - Pace of technological change
  - Short(er) cycle time
  - Strong industry orientation with application of industry 'tools' and processes, with industry experts
  - Integration of multi-disciplinary knowledge and skills

  - Needs of adult learners / professionals
    - More problem-centred than subject-centred
    - Better capable of self-direction
    - More flexible / adult friendly modes of engagement e.g. employment of technology-assisted / e-learning

Professional Learning

The development of professional capabilities through teaching and learning experiences and activities that integrate (i) academic, (ii) discipline-specific and (iii) industry-referenced knowledge, skills and attitudes

* Lawson, R., Fallshaw, E., Papadopoulos, T., Taylor, T. & Zanko, M. (2011). Professional Learning in the Business Curriculum: Engaging Industry, Academics and Students. Asian Social Science, 7 (4), 61-68.

Professional Learning Approaches*

- 1 — Industry Case Studies
- Industry Study Tours — 3
- Industry Projects — 2
- Industry Placement
- Industry Competitions
- Industry Mentoring
- Industry Seminars — 4a
- Industry Practitioner Delivery — 4b

* Lawson, R., Fallshaw, E., Papadopoulos, T., Taylor, T. & Zanko, M. (2011). Professional Learning in the Business Curriculum: Engaging Industry, Academics and Students. Asian Social Science, 7 (4), 61-68.

* Billett, S, Henderson, A. J. (Eds.) (2011). Developing Learning Professionals: Integrating Experiences in University and Practice Settings, Springer

SDIoT Curriculum

Post Diploma Certificate	Module	Coursework (Written Test) (%)	Exam (Written Test) (%)	Practical Work (%)
Fundamentals of Internet of Things	3D Printing Fundamentals (15 hrs)	-	100%*	-
	Engineering Basics (30 hrs)	-	100%*	-
	System and Programming Basics (30 hrs)	-	100%*	-
	Introductory Statistics and Analytics (30 hrs)	-	-	100%*
	Internet of Things (IoT) in Consumer Electronics, Health, Homes – A Case Study Approach (45 hrs)	40%*	-	60%*
Advanced Applications of Internet of Things	Internet of Things (IoT) in Cities, Industry, Business – A Case Study Approach (60 hrs)	40%*	-	60%*
	Design Thinking Capstone Project (90 hrs)	-	-	80%* 20%+

* Individual Assessment   + Team-based Assessment

Industry Case Studies

ST SINGAPORE | POLITICS | ASIA | WORLD | VIDEOS | MULTIMEDIA | LIFESTYLE | FOOD | FORUM | OPINION | BUSINESS

SINGAPORE > Courts & Crime | Education | Housing | Transport | Health | Manpower | Environment

Cat-and-mouse game with rats goes high-tech

1 of 2   Caught red-handed - screenshots from footage showing a rat cleverly avoiding a trap while stealing the bait. PHOTO: COURTESY OF PESTECH

PUBLISHED JUL 27, 2018, 5:00 AM SGT

Firm using sensors to monitor rodent activity; SMU will analyse its data to better understand how to trap rats

Case Study: Connected Mouse Trap
Company: Victor Pest Control

Issues:
- Product differentiation for the company
- Efficiency (use tech to reduce/avoid manual checking of traps)
- Low powered
- Strong enough signals

Industry Case Studies

Students engage in/with a range of disciplines / skills:

- Exploring the business / operational challenges
- Estimate cost and developing a Return of Investment (ROI) metrics
- Technical solutioning
    - Adopt industry informed processes or workflows*
- Outcome
    - Teams have competing views
    - Propose different solutions
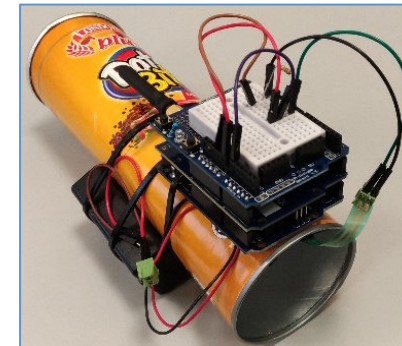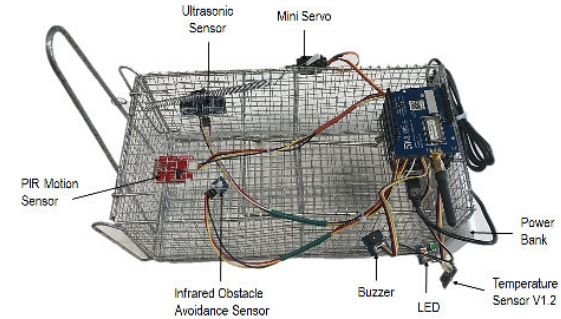
* Fuller, J. R. (2016). The 4 Stages of an IoT Architecture, Retrieved from https://techbeacon.com/4-stages-iot-architecture

# Story of a Squirrel in a Rat Cage!

Industry Case Studies

Case Study:
Overall Equipment Effectiveness (OEE) of Collaborative Robots

Company: Infinity Assembly

Issues:

- With more automation / robotics adopted, OEE, specifically uptime impacts profitability

Students engage in/with a range of disciplines / skills

- Adopt industry-based techniques (DMAIC)

- Employ data analytics to analyse sensor data and determine the sensor data effective for tracking OEE
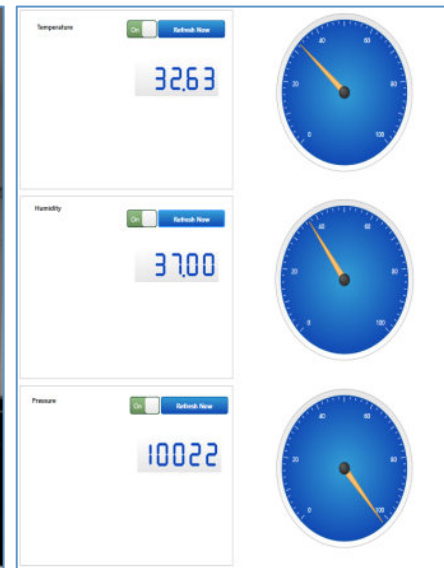
Insights on Industry Case Studies

- Pros
  - Use of case studies motivated the students with going deeper and picking up related skills
  - Experienced the handling of real world data e.g. with the associated 'noise'
- Cons
  - Specifically for Case Study #1, time allocated for data collection is more limited
    - Considered simulated data sets but not necessarily easy to find relevant ones

Industry Capstone Project

- Students undertake a large(r) scale prototype IoT solution
  - Problem scenario is provided by an industry partner
  - Where appropriate, a scenario from the student's workplace can be preferred
  - Design, architecting and development of the solution is done as a team (like the real-world)
- Incorporation of Design Thinking
  - Methodology that is solution-focused and oriented towards a preferred solution for the end-user / client
  - Meant to trigger imagination, intuition, logic and systemic reasoning in the students (esp pertinent for Smart Cities)

Design Thinking

- Students attend a series of Design Thinking Workshops in the Industry Capstone Project module
- The 5 iterative stages:
  - <u>Empathize</u>
    - Students have to gain an empathic understanding of the problem
  - <u>Define</u>
    - Students construct points of view based on the information gathered at the Empathize stage
  - <u>Ideate</u>
    - Students brainstorm, start to generate ideas and come up with creative solutions
  - <u>Prototype</u>
    - Students have to build representations of their ideas
  - <u>Test</u>
    - Students test their ideas or solutions rigorously (and iteratively).

Smart Energy Management System

- **Problem:** Consumer energy saving efforts are faced with one or more of the following hurdles:
  - Lack of awareness of device
  - No real-time feedback
  - Expensive and not cost-effective solutions

- **Requirements:** To develop a Smart Energy Management System
  - Real-time data
  - Easily available and convenient
  - Affordable price

- **Solution:** We plan to develop Smart Energy Management System to provide consumers with a real-time dashboard at the convenience of a smart phone at an affordable price at a small fraction of current available device

- **Technologies:** Current Sensor, IoT Device, Cloud-Based Data Storage, Smart Phone Integrated Dashboard, Data Analytics and Machine Learning
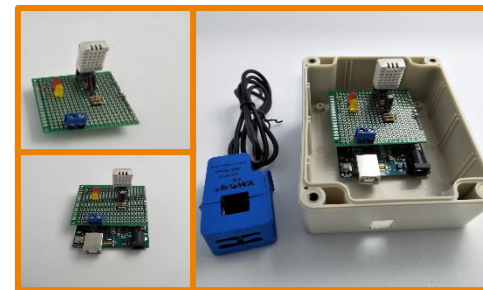
Partner Organisation: *ASE Singapore Pte Ltd*

Insights on Industry Project

- Pros
  - The genesis of industry projects are very relevant to students and this motivated to many students doing well in this module
  - Industry projects and the SD, broadly, contributed to the employment opportunities of students
  - Students were able to transfer the skills learned from one IoT platform to other IoT platforms even though not taught
- Cons
  - Students did find challenges with finding time to meet up outside of classroom hours
  - Less IIoT possibly due to resourcing concerns and such projects can't or its not easy to prototype in their own work environment
  - Other issues include NDA (students who could be a competitor), security, working hours (availability of weekday evening, weekend for students), equitability of scope
- Possible Solutions
  - Get industry partners who can bring their projects in for students

Industry Study Tours

- Purpose:
  - Allow students to see theory in practice
  - Allow students to enquire of professionals on site specific issues / challenges on the ground
  - Allow students to connect classroom learning to industry practice
  - Its just a fun outing!
- Example:
  - Centre of Innovation for Supply Chain Management (COI-SCM)
  - Specializes in innovation, process re-engineering, and the adoption of technology, including IoT to help companies improve on their supply chain capabilities
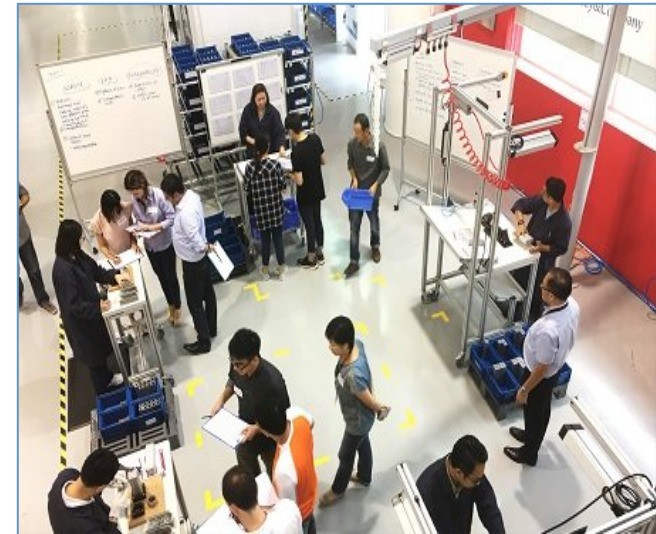
Industry Practitioner Delivery

- Industry practitioners are engaged in:
  - Regular modules
  - Assessing student projects
  - Conducting specialized seminars / lectures
- Example:
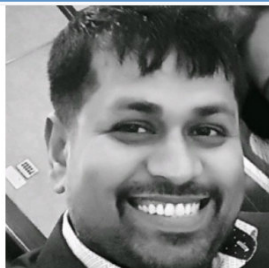
CK Vishwakarma

Founder

CK Vishwakarma is a Senior Business Strategy, Program Management and Technology leader with over 15 years of extensive international experience in solutions architecture, program management, and business process transformation. CK works with organizations crafting Digital Journey, and MakeIoTHappen Strategy. CK also conducts business and technology research, and has spoken at 40+ leadership forums, prestigious international conferences. He advises senior leaders, startups & SMEs on how advanced technologies can prime enterprises for the future. He has created new strategies, and frameworks on how the traditional methods of operational technologies can be integrated with new connected technologies for the successful implementation of Digital Initiatives. He founded both IoTSG and AllThingsConnected, IoTSG is the biggest IoT and Deep Tech focused Special Interest Group in South East Asia, AllThingsConnected is an end to end IoT project organization based in Singapore. He is also an adviser to numerous IoT startups, and incubation programs, and an Associate Faculty-IoT at Singapore University of Social Sciences & Republic Polytechnic, Singapore. He earned his bachelor's degree in electrical engineering from Indian Institute of Technology & master's degree in mechatronics from National University of Singapore. He is a certified Project Management and Risk Management Professional by Project Management Institute, USA. He lives in Singapore.

Industry Seminars

- Example:
  Cyberattacks on IoT Systems by MicroSec (https://www.usec.io/)
- Synopsis
  The seminar addressed the state of security in the IoT space, the pros and cons of current security technologies and standards in IoT, the challenges of Public Key Infrastructure (PKI) in IoT and future security challenges envisaged in IoT

Cybercriminals are getting better at launching sophisticated attacks that easily get past traditional security tools such as endpoint anti-virus systems and firewalls. The reality is: traditional cybersecurity is aimed at ensuring compliance and this is no longer enough. PHOTO: REUTERS

Government resumes Smart Nation initiatives after SingHealth attack

It plans to implement more cybersecurity measures for critical government systems.

The government lifted its pause announced on 20 July to work on its new ICT systems after the hacking incident on SingHealth, the Cyber Security Agency of Singapore and the Smart Nation and Digital Government Group (SNDGG) revealed.

The agencies said that SNDGG has finished its review of cybersecurity policies after the cyberattack and will implement more measures for critical government systems.

Industry Associate Scheme

- Key Enablers for PL
  - Institutional support in encouraging professional learning i.e. policies and procedures that are "friendly" when engaging external industry partners.
  - Staff being encouraged to develop their teaching practices for professional learning. Staff within the institution need to also work with industry partners to ensure academic rigour.

- RP has an internal capability development scheme
- Objectives of the scheme:
  - Allow academic staff to develop strong links with the industry and facilitate collaborations with them.
  - Enable academic staff to keep abreast with the industry trends and be exposed to cutting-edge technologies.
  - Increase the staff's capability to create relevant educational problems / learning material
  - Allow the academic staff to incorporate current industry practices into the academic curriculum.
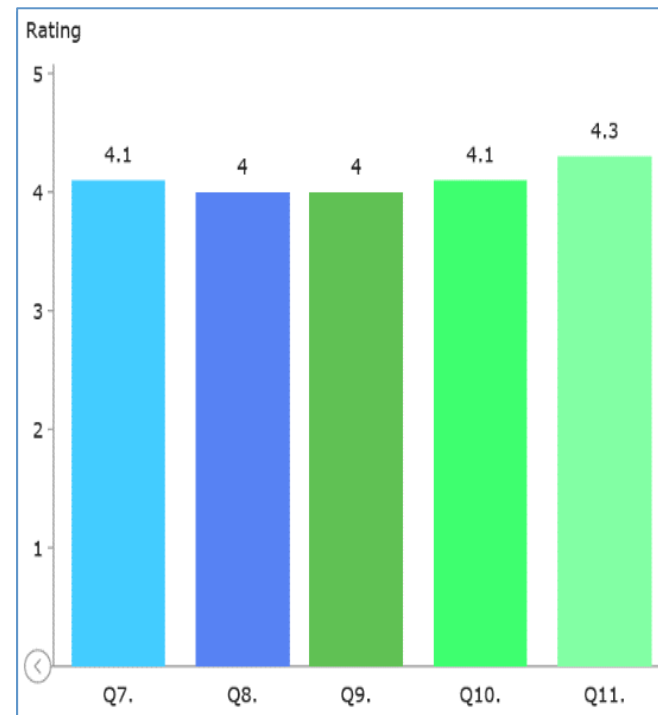
Mobile Learning Platform
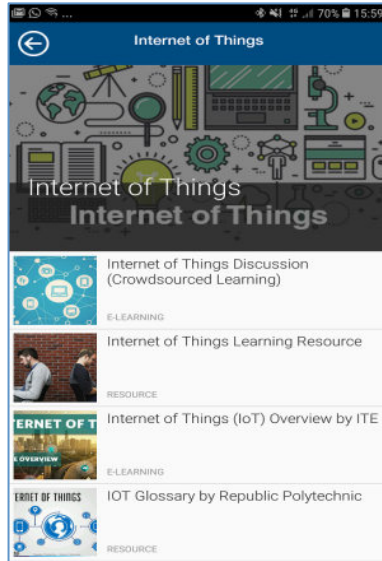
Screen 1
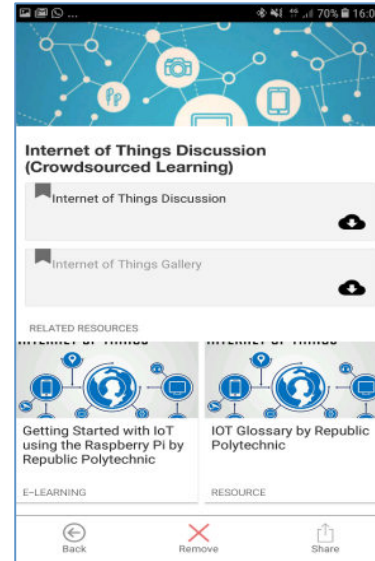
Screen 2

- As working professionals, the platform allows participants to tap on a convenient learning application to get quick, up-to-date, bite-size information (Screen 1)

- And exchange know-how with other experts in the field, including trending discussions, as part of a wider learning community (Screen 2)

Student Feedback

Q1	The objectives of this module are clearly stated.
Q2	The module has achieved its learning objectives.
Q3	The coverage of the module is adequate.
Q4	The depth of the module is appropriate.
Q5	The lesson materials (lecture notes/hand-outs, worksheet questions, laboratory and practical worksheets) are well designed and organised.
Q6	The lesson materials (lecture notes/hand-outs, worksheet questions, laboratory and practical worksheets) have aided my understanding of the topics covered.
Q7	The contents (such as concepts and skills) presented in this module are useful and relevant to my work.
Q8	The amount of work required in this module is reasonable.
Q9	The assessment method(s) for this module is appropriate and fair.
Q10	The recommended list of readings and resources are useful in increasing my understanding of the contents covered.
Q11	My overall rating of module delivery is…

Rating

Q7.	Q8.	Q9.	Q10.	Q11.
4.1	4	4	4.1	4.3

Thank You

Q & A?!