IoT Living Laboratory @ AIT

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Asian Institute of Technology (AIT), Thailand
March 2015

AIT

Partnering Asia's Future

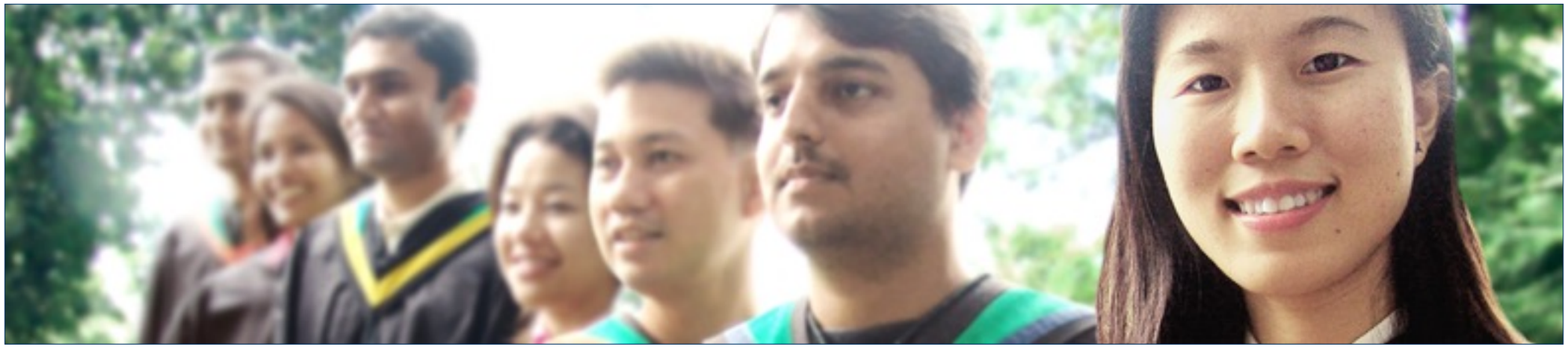
AIT
Asian Institute of Technology

With merely 18 students from 3 countries in 1959, AIT has produced over 14,000 alumni from 74 countries.

Guided by a Board of Trustees from 25 countries

Supported by governments, foundations, international agencies, business enterprises, and individuals.

ASIAN INSTITUTE OF TECHNOLOGY



Mission

To develop highly qualified and committed professionals who will play a leading role in the sustainable development of the region and its integration into the global economy

Key Facts

1,652 Students from 48 Countries/ Territories

20,867 Alumni from 97 Countries/ Territories

29,000+ Short-term Trainees from 70+ Countries/Territories

503+ Research and Support Staff from about 30 Countries

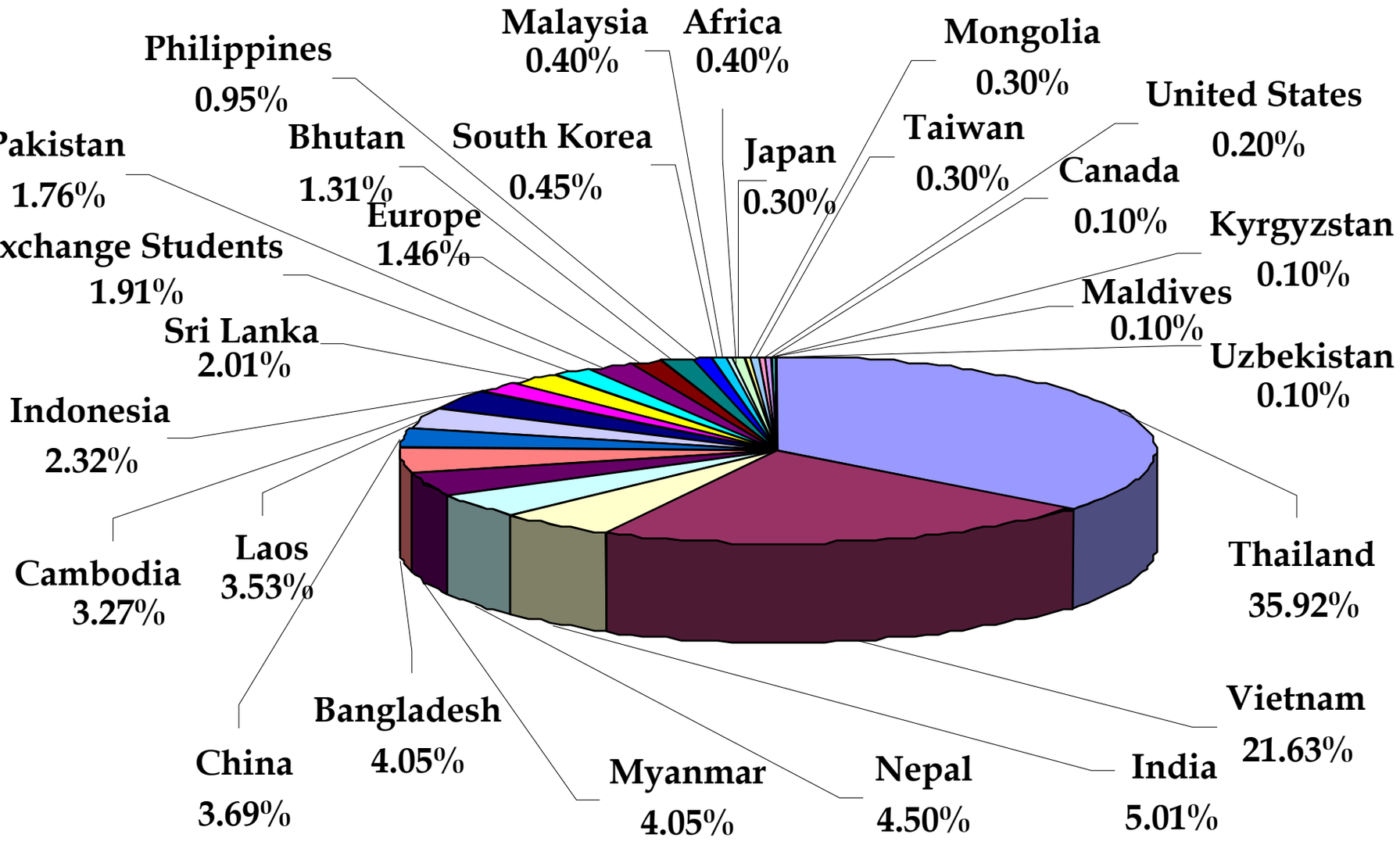
101 Adjunct Faculty/ Visiting Faculty

75 Internationally recruited Faculty from 20+ Countries

Approximately 450 Sponsored Research Projects –
1.6 Billion THB

ASIAN INSTITUTE OF TECHNOLOGY

Students



AIT Centers and Satellite Campus

AIT Center in Vietnam

IntERLab

AIT Extension

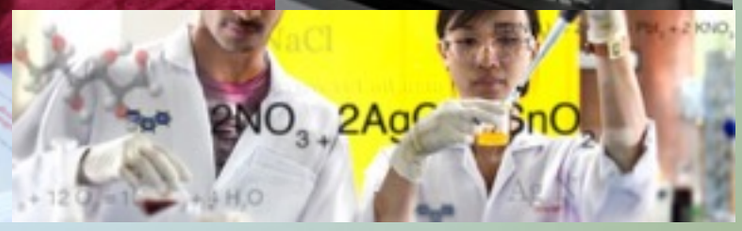
AIT CONSULTING

Technology . Engineering . Environment . Development . Management

Centre of Excellence on

SDCC Sustainable Development in the Context of Climate Change

CoEN @ AIT



Introduction

Our Vision

Practical WSN & IoT Laboratory for Real-world Applications in Developing Countries

Objectives

1) To realize and test a number of small but practical IoT system that can lead to large-scale & sustainable solutions

Air Pollution

Agriculture

Objectives

2) Smart Campus as a living technology testbed

Objectives

3) SMART VILLAGE : Rural Community Development

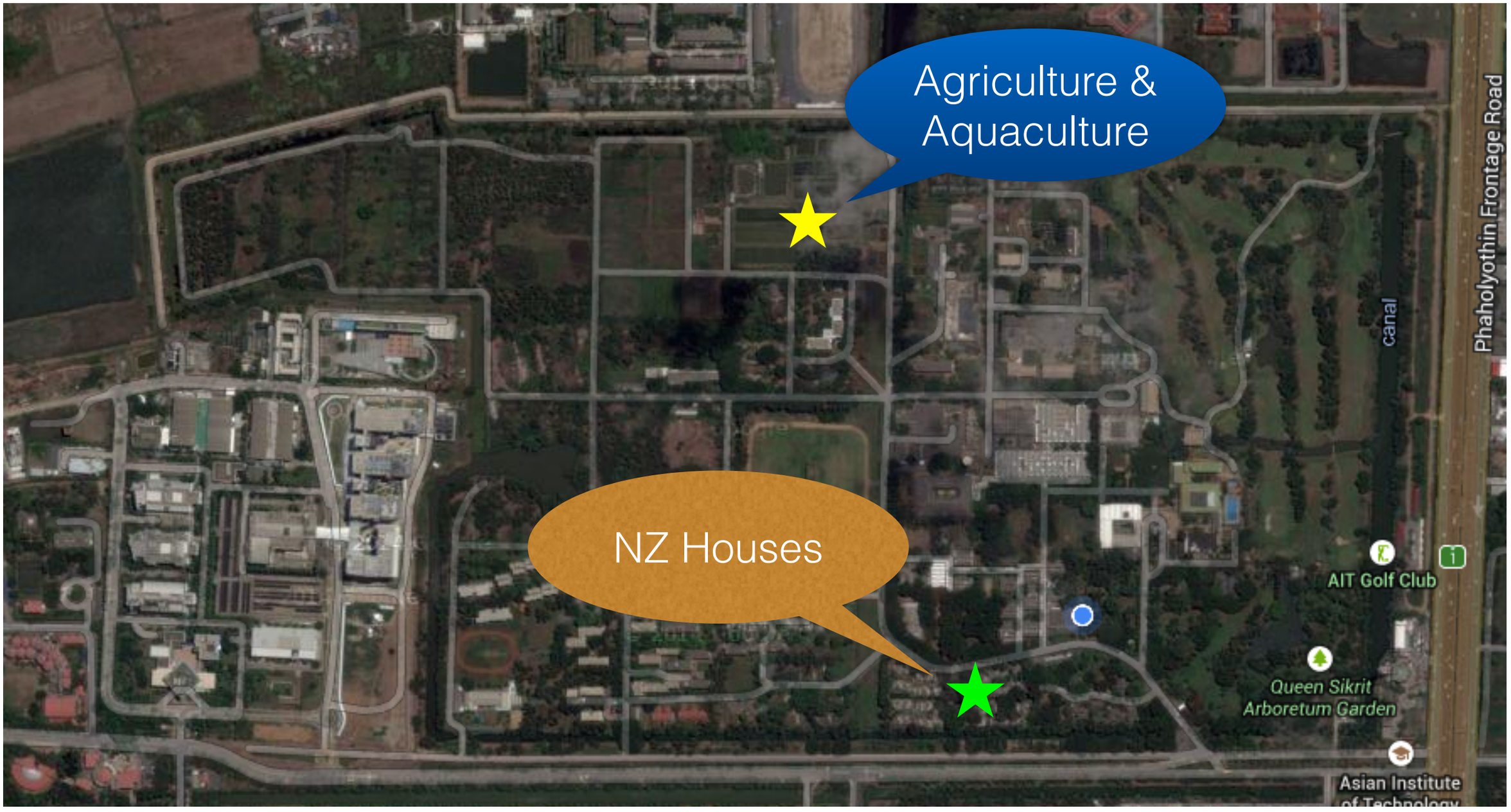
home use

Target Domains

- "Smart"
  - Quality Living: waste treatment, air quality
  - Energy Efficiency
  - Smart Services
  - Agriculture & Food Production Applications
  - Pollution Monitoring & Control eg. haze due to forest fire

AIT Living Laboratory

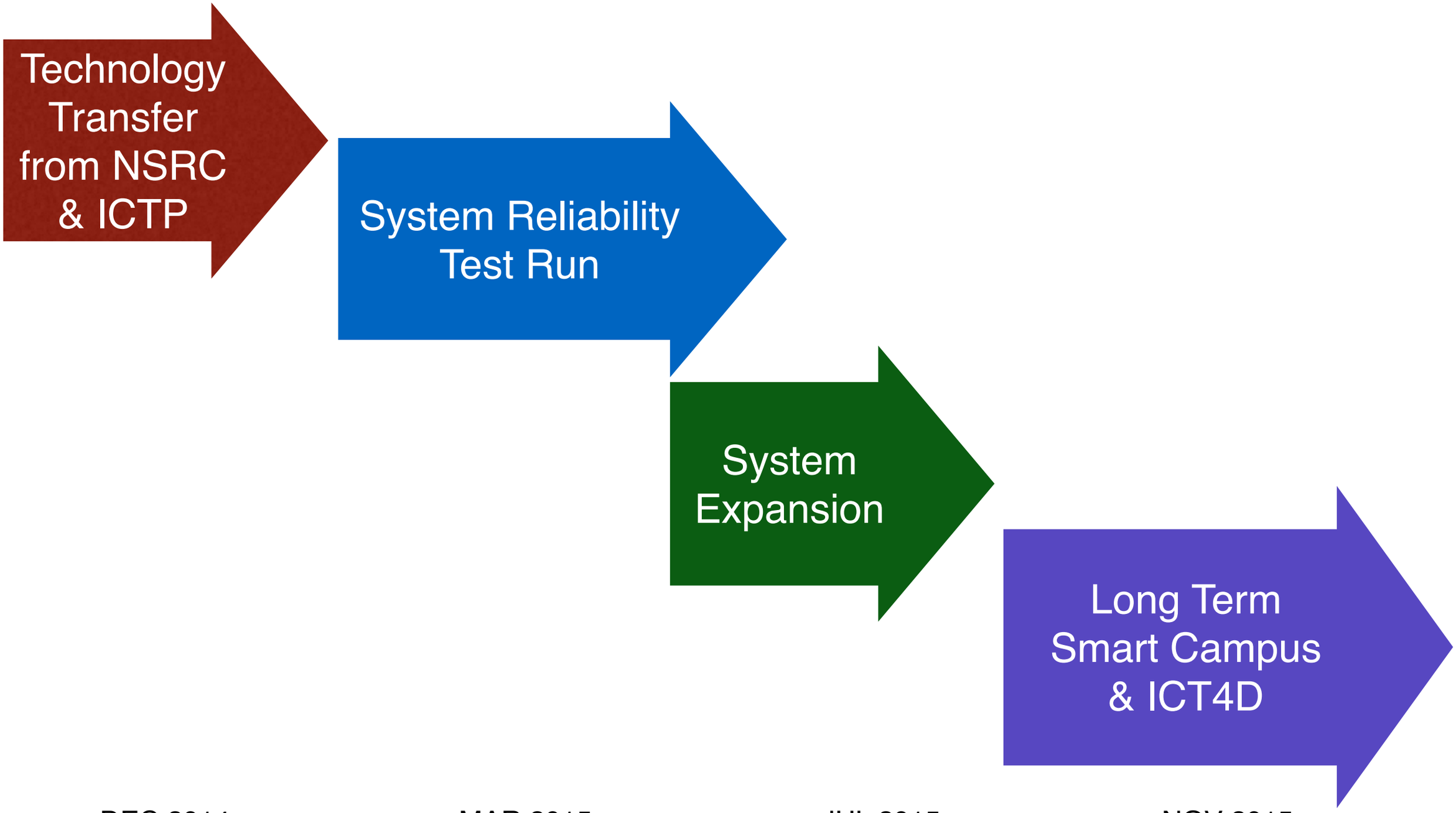
AIT Campus


Agriculture &
Aquaculture
NZ Houses
canal
Phaholyothin Frontage Road
AIT Golf Club
Queen Sikrit
Arboretum Garden
Asian Institute

AIT "Living" Laboratory

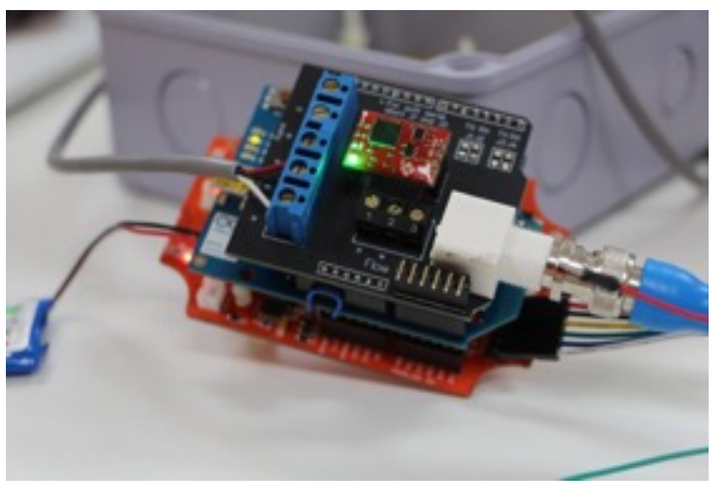
- To show how WSN/IoT can be used to monitor environmental conditions:
  - In residential areas
  - In plantation field & fish ponds

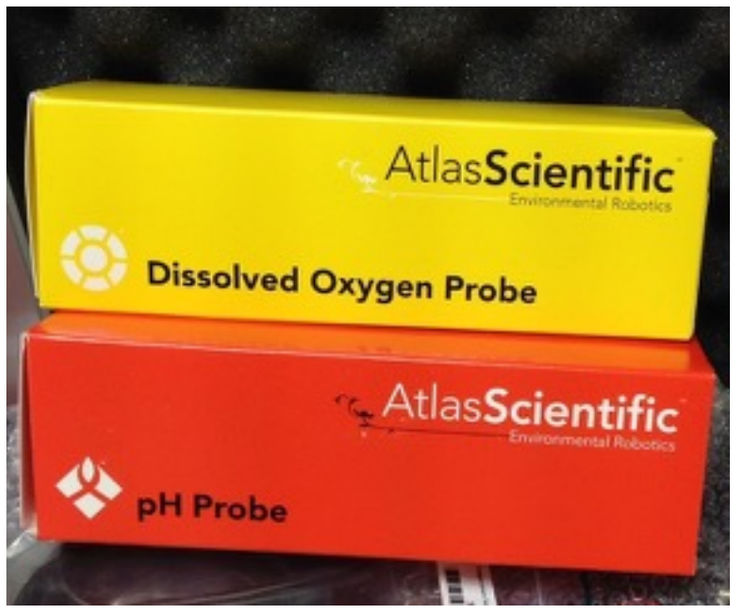
WSN/IoT Deployment Timeline



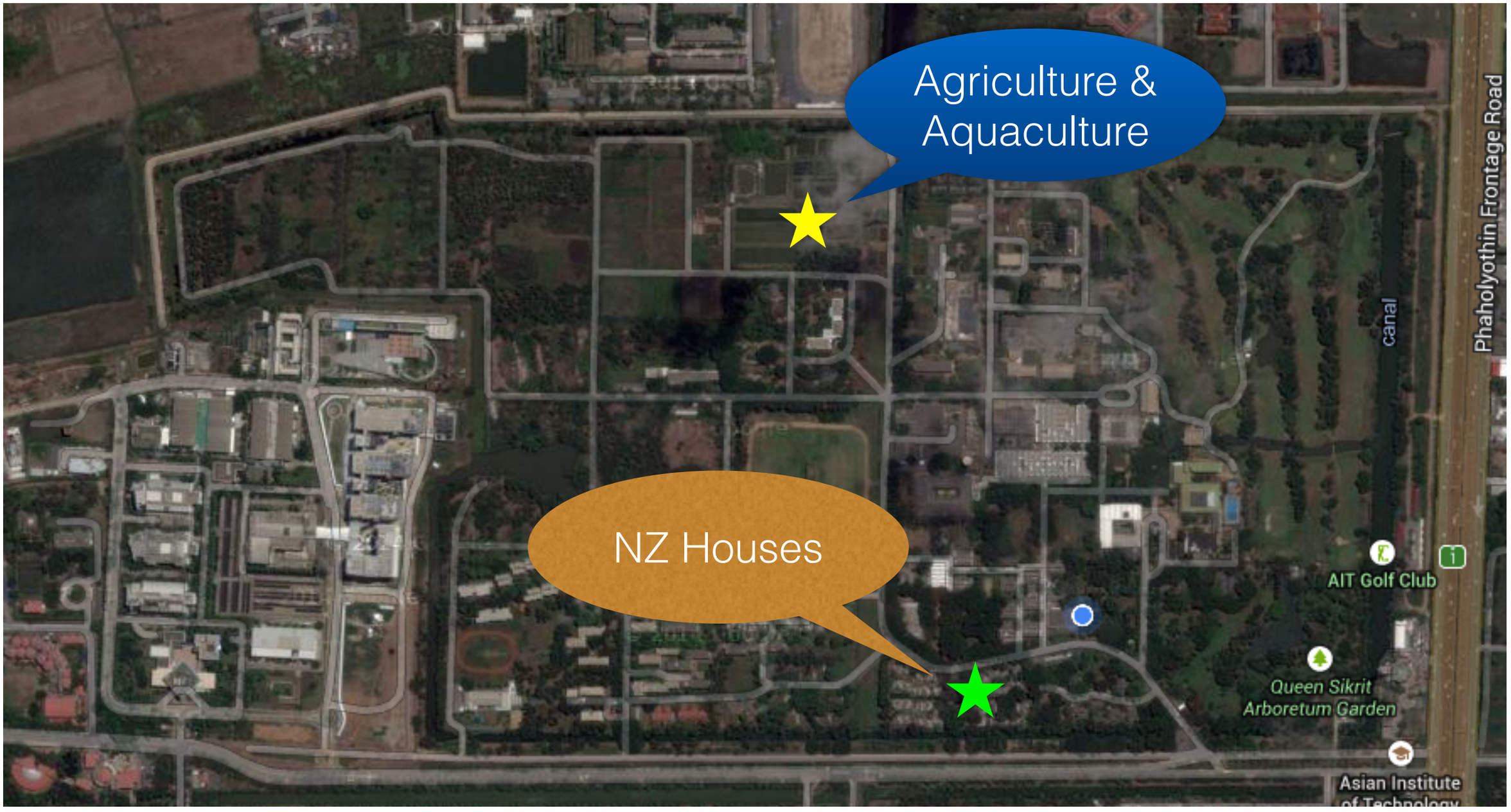
Training and Deployment

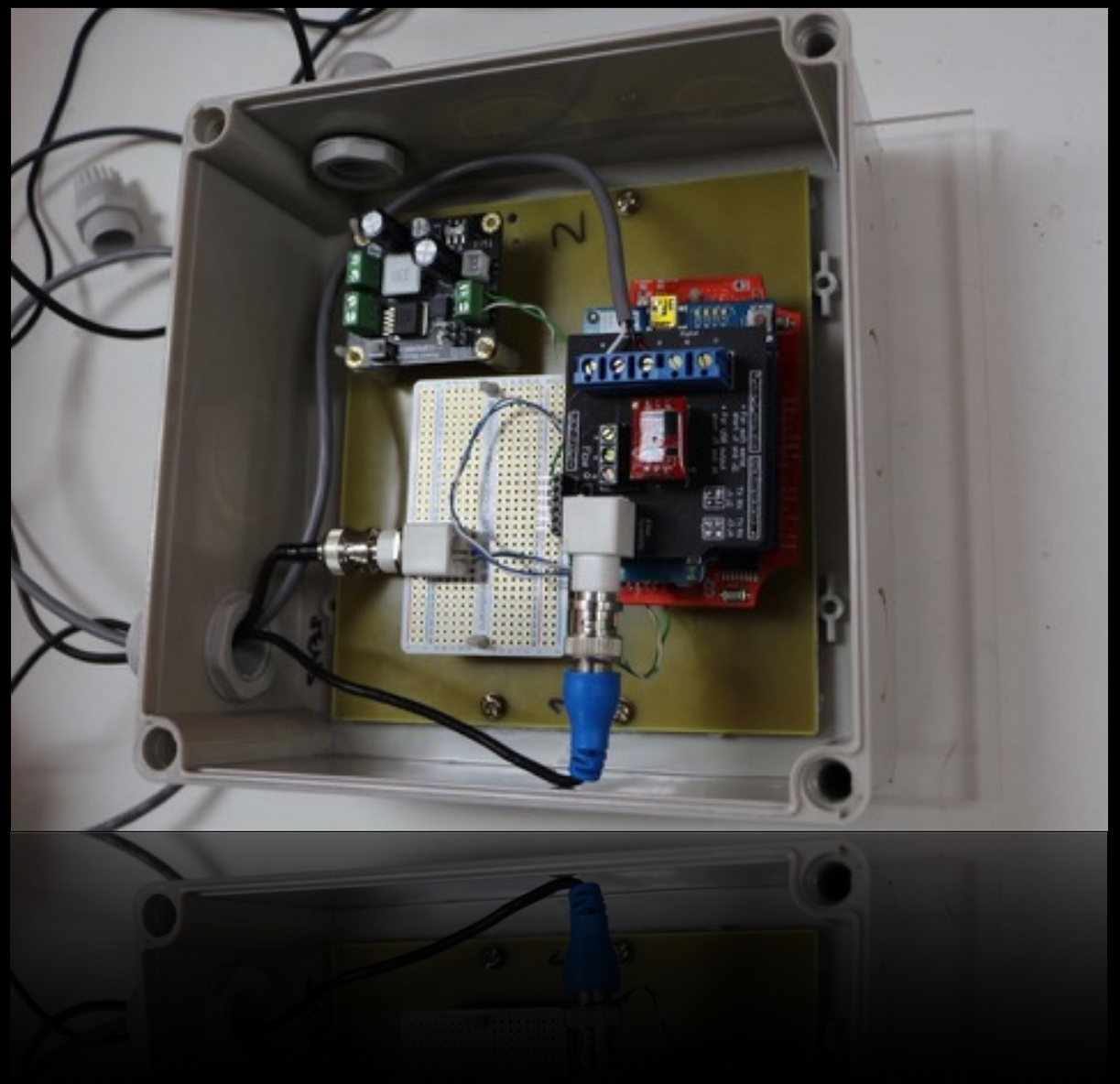
ICTP & NSRC-led WSN/IoT Workshop





On-Campus Deployment Locations

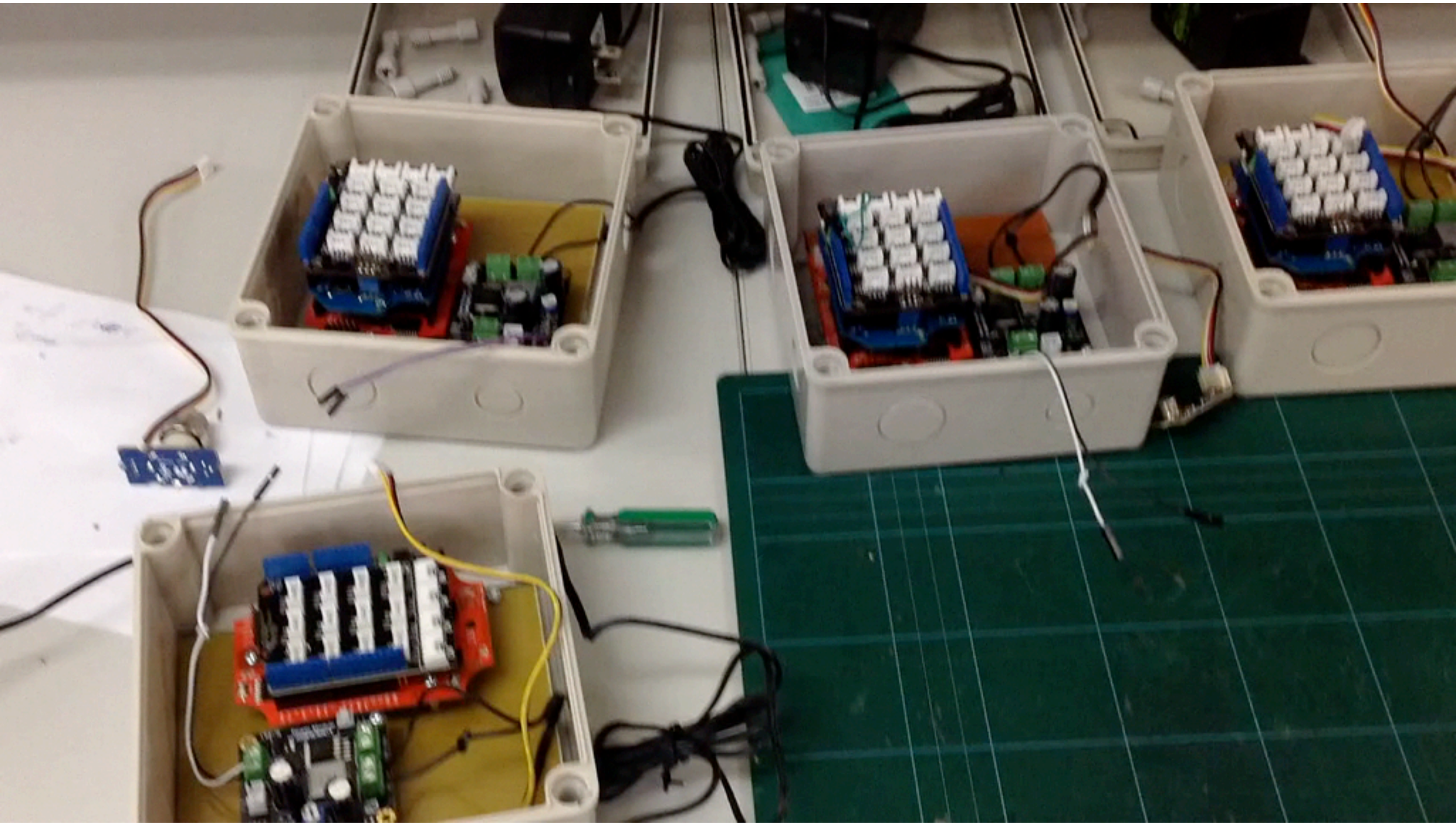




WSN/IoT Deployment @ AIT

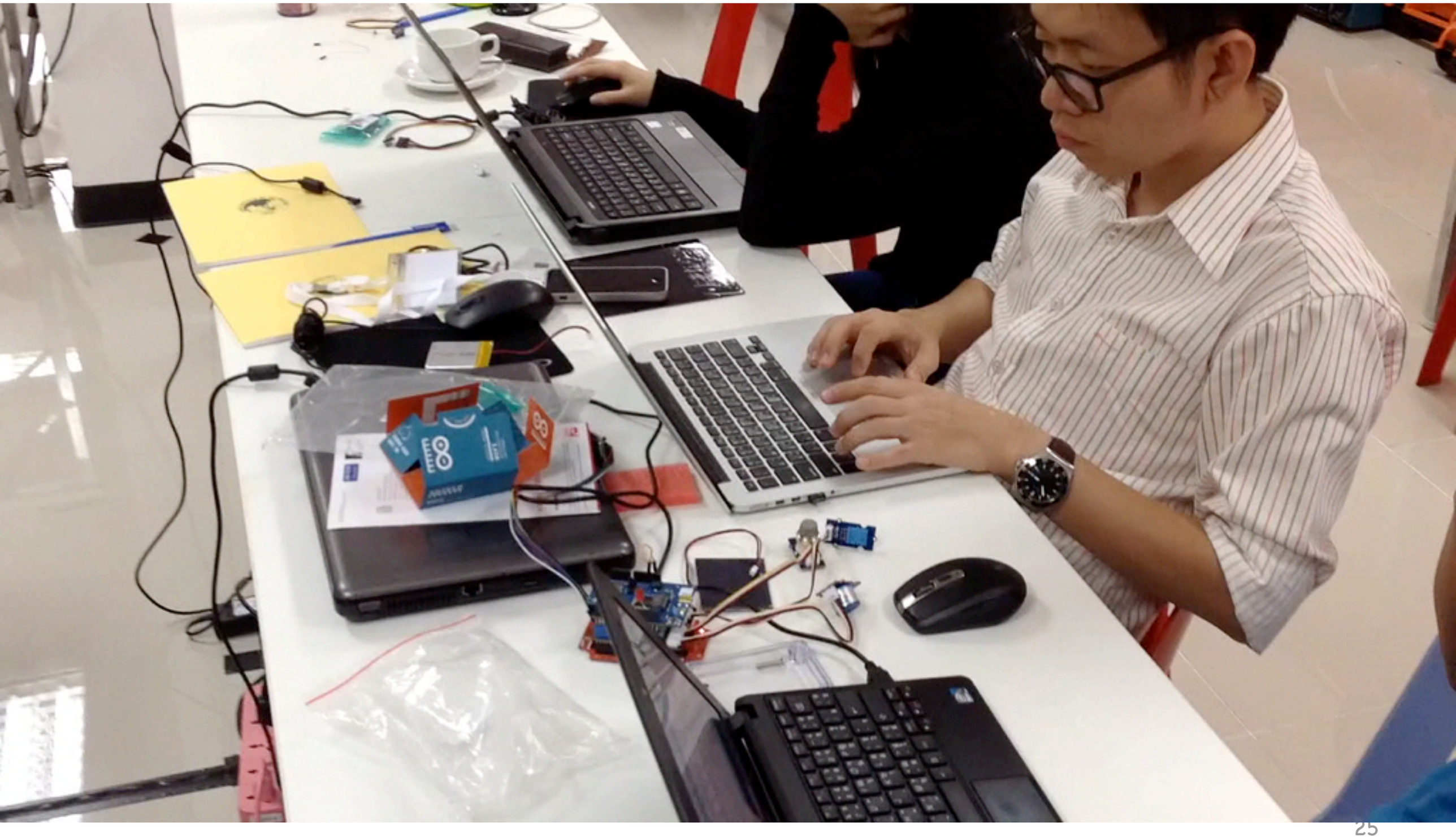
Video: Discussing Networking Requirements

Video: Building the Air Sensor Nodes



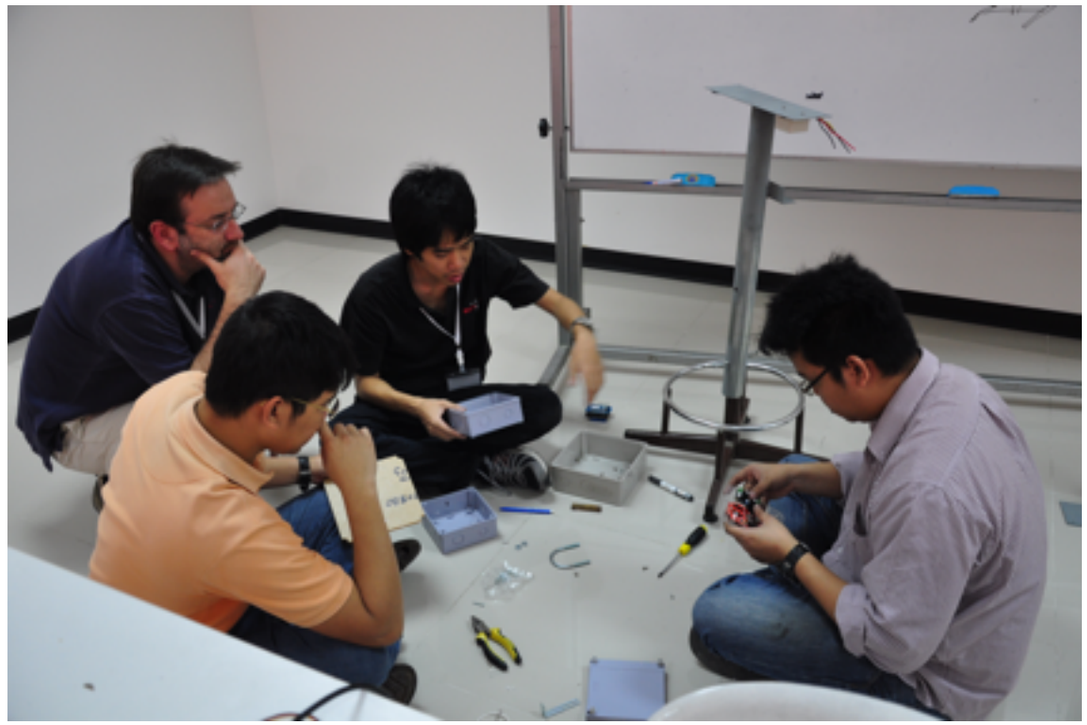
Video: Water Sensor Calibration

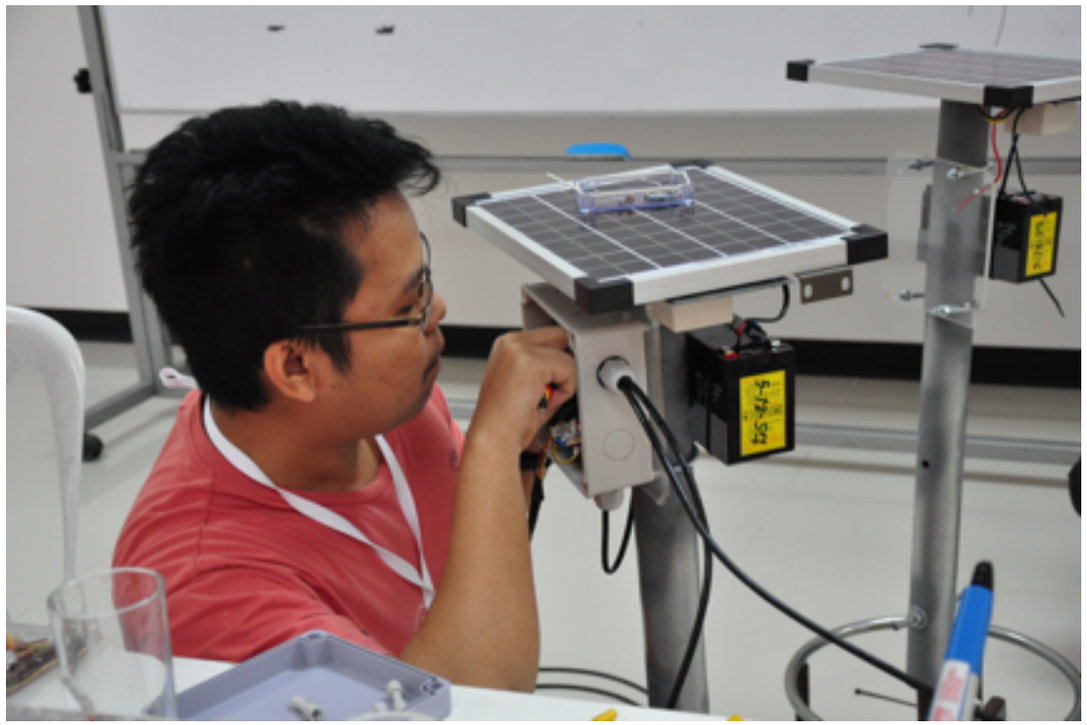
Video: Air Sensor Calibration



Video: Soil Sensor Calibration

Agricultural sensors @ AIT

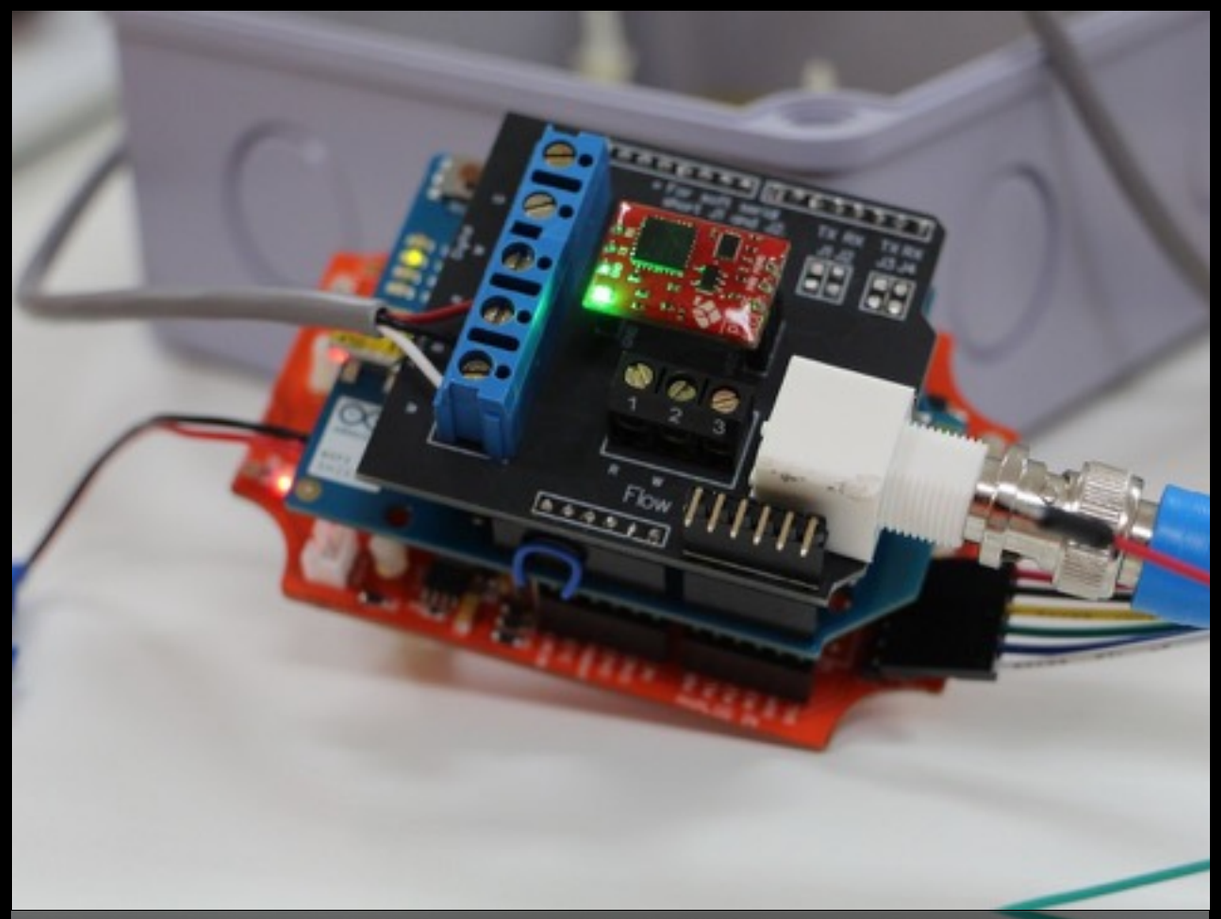




New Zealand Houses @ AIT

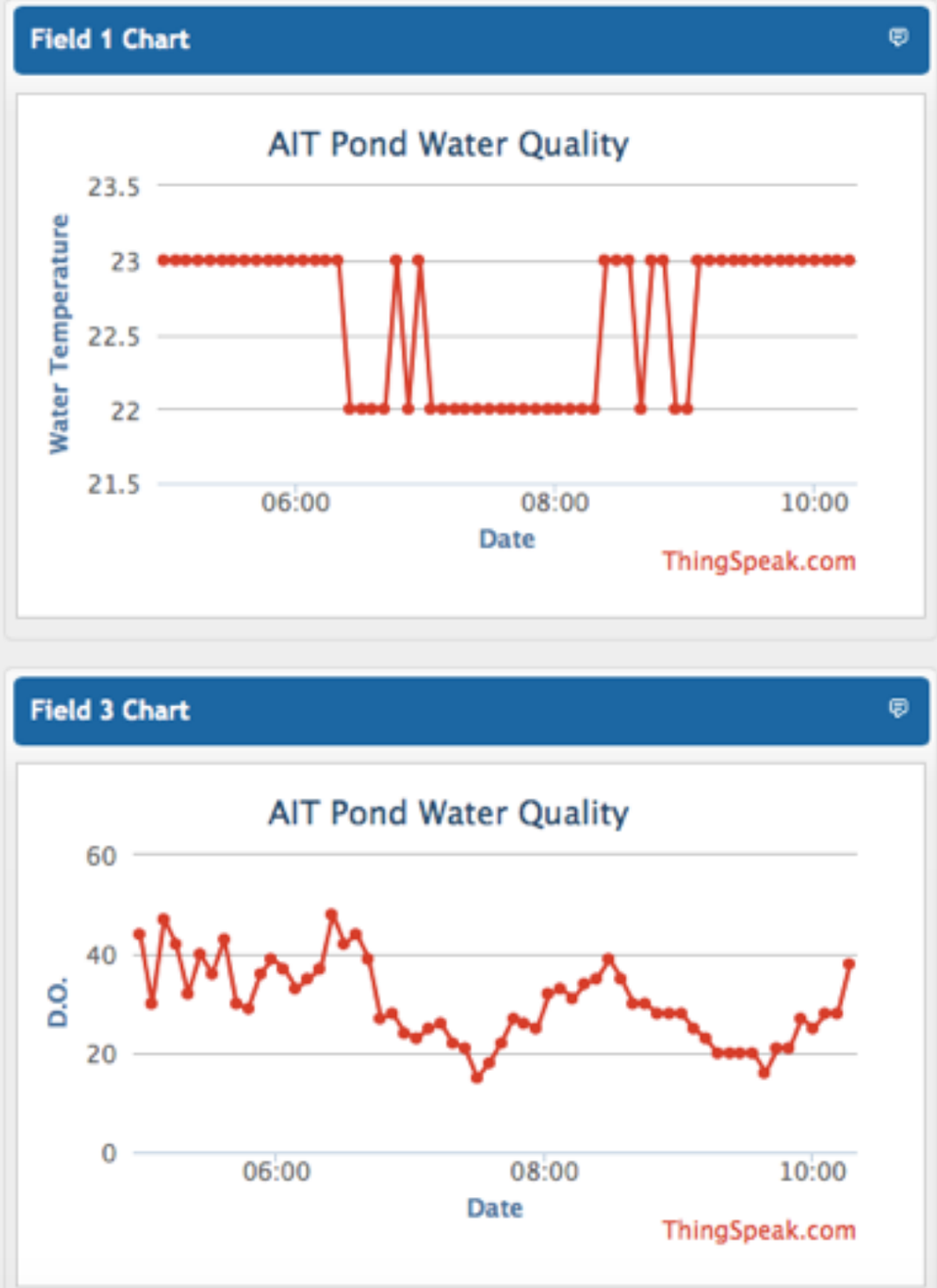
Video: Solar Power for the Fish Pond Sensor

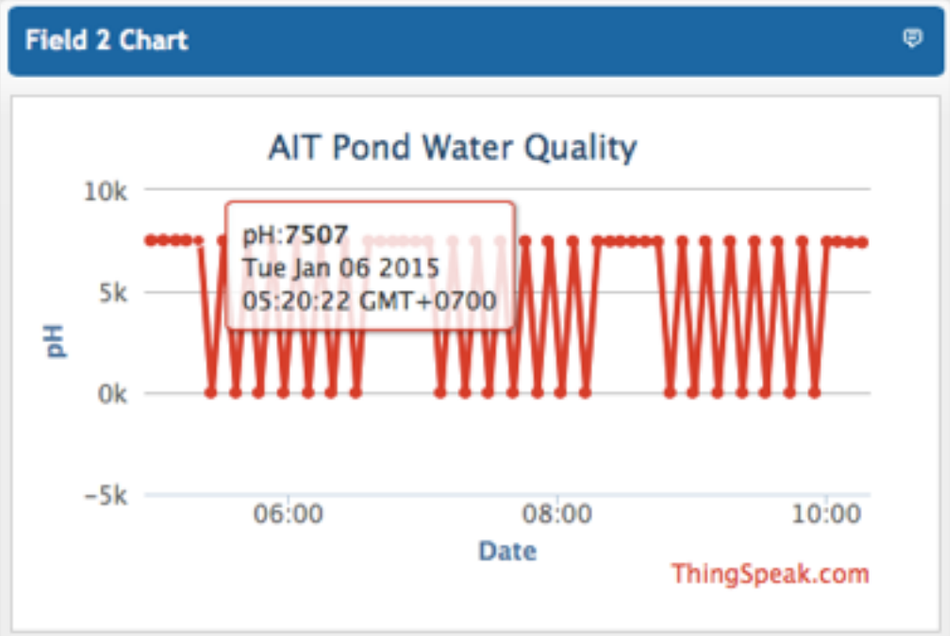
Wireless Sensor Network Testbed @ AIT



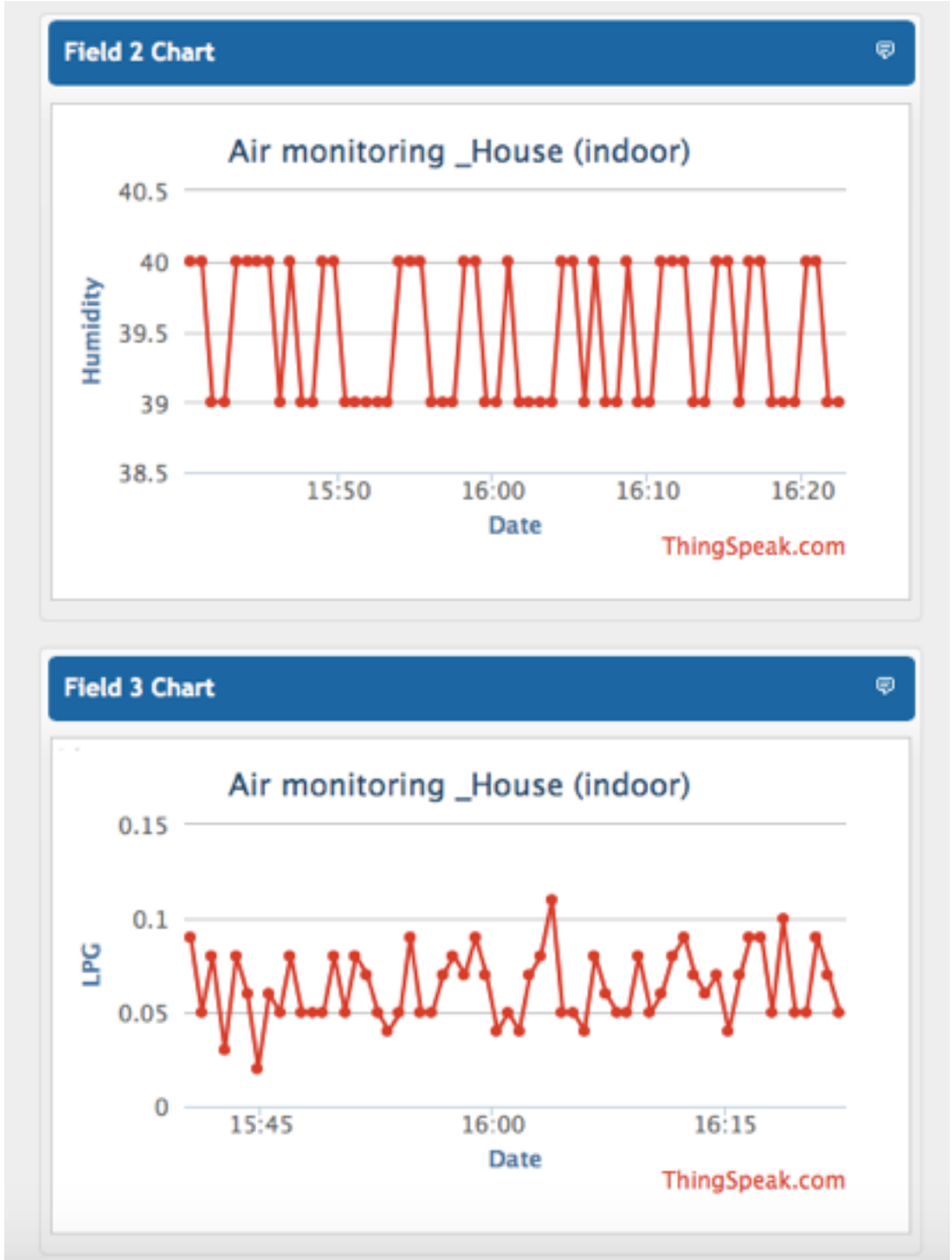
Wireless Sensor Network Testbed @ AIT

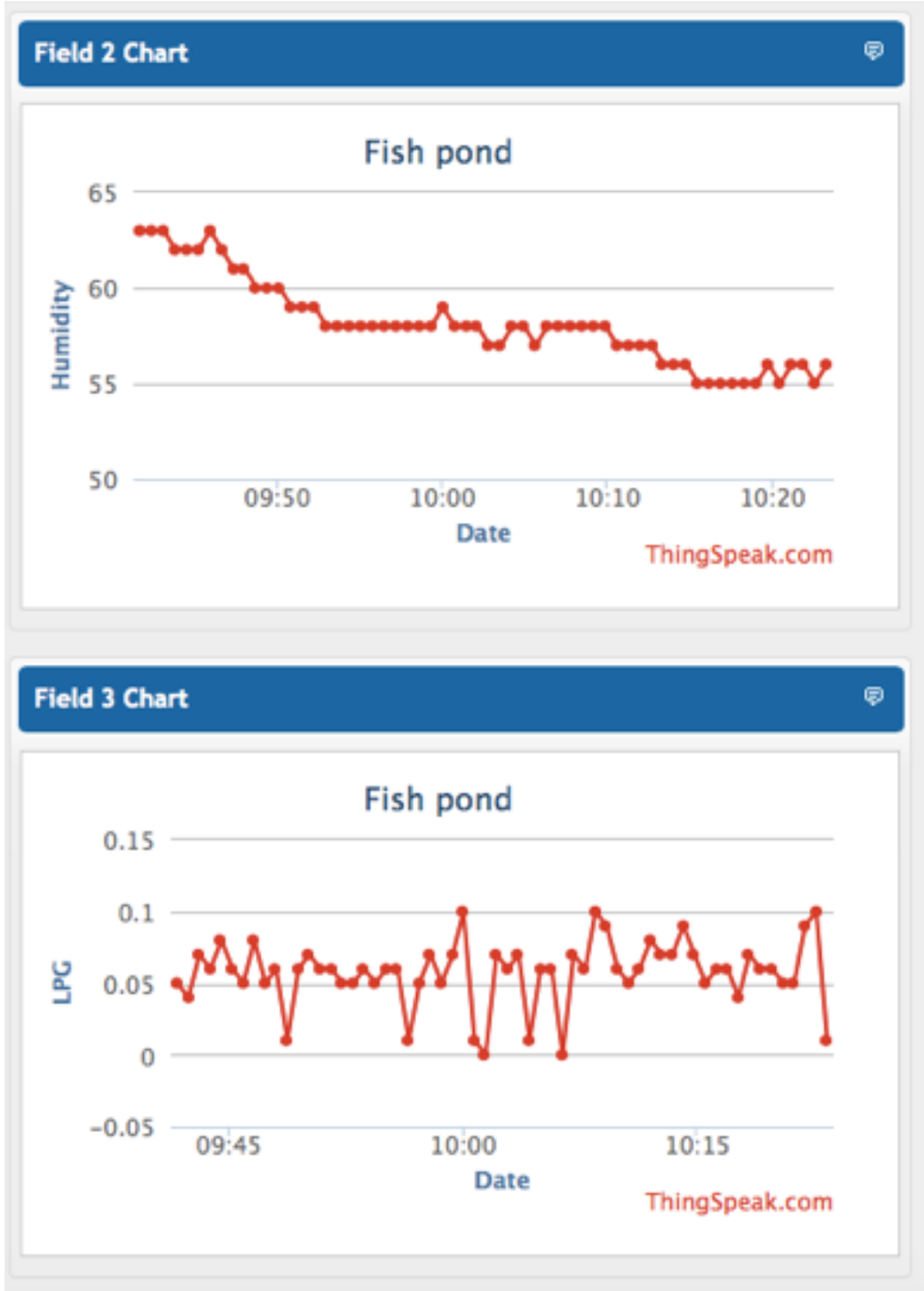
Monitoring : pieces of "Big Data"





Monitoring : pieces of "Big Data"





Deployment Summary

- We are able to monitor certain environmental conditions
  - Temperature
  - Humidity
  - Air Quality
  - Gas
  - Water Temperature
  - Water pH
  - Water Dissolved Oxygen (D.O.)

Troubleshooting

Problems found:

- Power disruption
- Need constant power supply
- Weak WiFi signal
- SW versions: ‘new line’ problem prevented ThingSpeak to accept HTTP POST messages correctly.
- DHCP lease time - prolonged lease time

Towards a Living Lab Campus

"Smart" Living Campus

- Energy Efficiency
  - Solar
  - Mini Energy Grid
- Green & Clean (Environmentally Aware)
  - Solar septic toilets
- Off-Balance Alert & Warnings
- IoT R&D Showcases

Energy-Efficiency

Energy from Solar Rooftop

Temperature

Humidity

Light

Connected Air-conditioning System

Post-Workshop Discussions

Traditional vs. New

Dr. Salin's Interview

- The new system makes it more automatic and productive for water quality measurement and for fish farms
- AIT has good connections with Thailand and Mekong area, AIT can scale and test the technology regionally.
- When combining aquaculture with agriculture, we get both fish (i.e. protein) and other vegetable produces (i.e. other nutrients).
- In such a system, we will require continuous monitoring of water quality. Oxygen, nitrites, ammonia levels have to be measured, in addition to what we have.

Gabriel's view on future deployment

Gabriel's suggestions

Mr. Gabriel's Interview

- The deployment has been a great success !
- He is looking at the opportunity to scale up to regional level
- He envisions a system that can measure water quality in ponds and canals and provide time series like those we have in weather monitoring
- For the fish pond, we should add the sensors for ammonia, nitrates/nitrites, and alkalinity. These are major fish killers.

Agriculture: Dr. Peeyush Soni

Dr. K.R.Salin's AIT's role for regional deployment

Dr. Peeyush Soni's View on the Future

Dr. Soni's Interview (cont.)

- It can be extended to roof-top agriculture in the city. The concept is being developed
- AIT buildings can be equipped and tested to prove the concept.
- Another area may include biogas production. It requires sensors.
- The other area can be the monitoring of tractor/combine harvester's use. These are expensive machines. We can see how much fuel is used to grow plants and charge accordingly. We can characterize productive vs. unproductive times (e.g. plowing the field vs. adjusting/ turning).

Dr. Salin's AIT living campus for peri-urban small farming

Towards peri-urban farming: Bayu

- After the WSN workshop in December 2014 , we successfully deployed many sensor nodes across AIT campus. We also deployed agricultural sensors in plant field.

Bayu's view

- What are the benefits from these sensors ? How can you apply data collected from the sensors for your planting?

Bayu's farm at his dormitory

- What do you expect from future deployment of the agricultural sensors in AIT campus?

ASIAN INSTITUTE OF TECHNOLOGY

School of Engineering and Technology

- Computer Science
- Design and Manufacturing Engineering
- Industrial Engineering and Management
- Information Management
- Remote Sensing and Geographic Information Systems
- Telecommunications
- Information and Communications Technologies
- Mechatronics
- Microelectronics
- Construction, Engineering and Infrastructure Management
- Geotechnical and Geoenvironmental Engineering
- Structural Engineering
- Transportation Engineering
- Water Engineering and Management

School of Environment Resources and Development

- Agricultural Systems and Engineering
- Aquaculture and Aquatic Resources Management
- Energy
- Environmental Engineering and Management
- Food Engineering and Bioprocess Technology
- Gender and Development Studies
- Natural Resources Management
- Pulp and Paper Technology
- Regional and Rural Development Planning
- Urban Environmental Management

School of Management

- International Business
- International Public Management
- Management of Technology
- Service Marketing and Technology
- Executive MBA
  EMBA Bangkok EMBA Vietnam
  EMBA-HRM

AIT Extension (Non-degree training, consultancy and services)

- Agriculture, Resources and Rural Development
- Business Management
- Development Management
- Education and Training Development
- Environment, Infrastructure and Urban Development
- Information and Communications Technology

Integrated through an IoT Living Lab

Asian Institute of Technology

Thank You
谢谢
Dank Yu
Merci
Danke

धन्यवाद
Terima Kasih
Grazzie
ありがとう
감사합니다
ຂອບໃຈ

ขอบคุณ
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Takk
Cảm ơn ông
cè-zù-bèh

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