Mobile IoT

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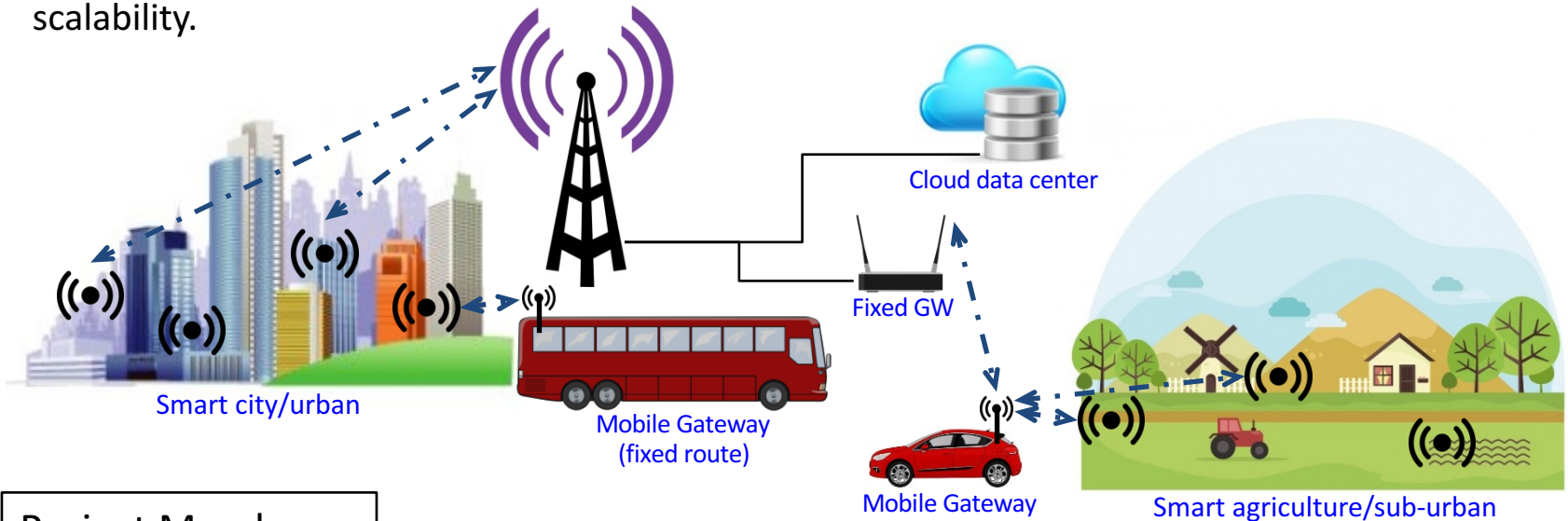
Presentation Outline

- Background

- Technical Updates
  - Mobile IoT Project Contribut0on of Vietnamese Team
  - Environmental/pollution Monitoring System

Project Title: Mobile IoT

Introduction :

Internet of Things (IoT) will be an integral part of our lives and is expected to improve every aspect of our daily activity. This project explores the feasibility and theoretically quantify the benefits of using mobile agents to help wireless sensor network operate more efficiently by reducing the required number of sensors, simplifying the deployment and setup, as well as improving its scalability.

Cloud data center

Smart city/urban

Fixed GW

Mobile Gateway
(fixed route)

Mobile Gateway

Smart agriculture/sub-urban

Project Members :

- Sumei Sun   Institute for Infocomm Research, Singapore
- Hiroyuki Yano   National Institute for Information and Communications Technology (NICT), Japan
- Fumihide Kojima   National Institute for Information and Communications Technology (NICT), Japan
- Nordin Ramli   MIMOS, Malaysia
- Ngo Quynh Thu   Hanoi University of Science and Technology (HUST), Vietnam
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Mobile IoT Project
Contribution of Vietnamese Team

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11/21/16

Outline

1. **Mobile IoT Introduction**

2. **Vietnamese Contributions:**

   a. **BK-IoT Platform and Applications: 3 papers submitted**

   b. **Coverage Area for Mobile IoT: 4 papers accepted, 3 paper submitted**

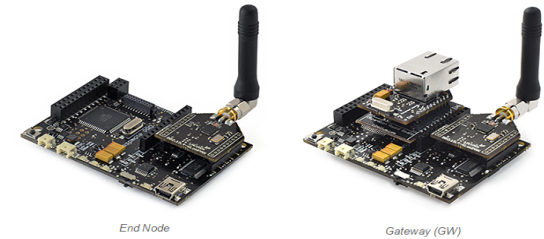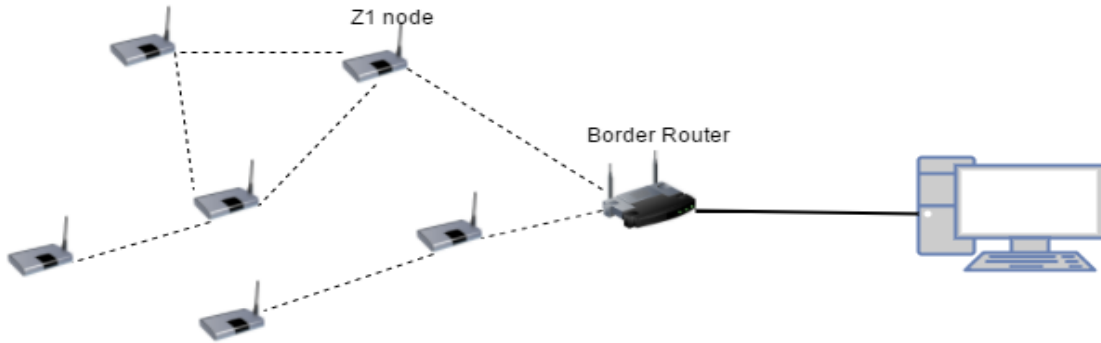   c. **Lightweight Security for Mobile IoT: preparing of 1 paper**

3. **Conclusion and Future Work**

1. Mobile IoT Introduction

a. **Mobile Gateway**

b. **Sensor and**

   Android-Phone

c. **OM2M Platform**

d. **MiMIST Platform**

2a. BK-IoT Platform and Applications (1)

Z1 node

Border Router

End Node   Gateway (GW)
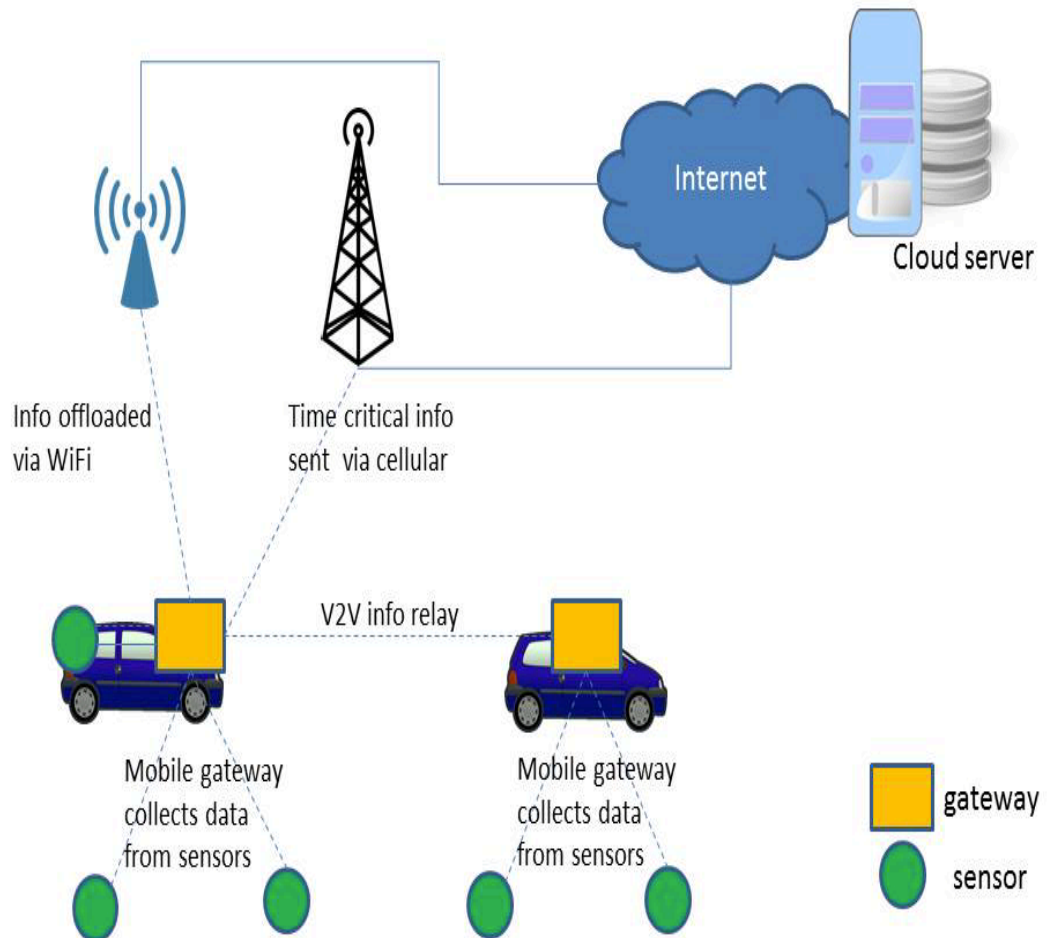
▶ **Border Gateway:**
  ▸ Z1 connected to Laptop, Raspberry Pi 2.

▶ **Sensors:**
  ▸ Waspmote, Arduino, Zolertia

▶ **Contiki Operating System**

▶ **Platform:**
  ▸ OM2M, MiMIST

2a. BK-IoT Platform and Applications (2)

- **Lung Functions**
  - **Android Smartphone**
    - measures Signal at Microphone
    - realizes signal processing and machine learning
    - Smartphone send PEF, FEV1, FVC to Platform
  - **Platform**
    - realizes machine learning for further diagnising of different related-diseases
    - Possible for COPD and different lung-diseases
    - Platform sends notification to users and doctors
- **Environment Monitoring Applications:**
  - **Sensors (Z1, Waspmote, Arduino)**
    - measure environment informations
    - Sends to the Gateway and Platform
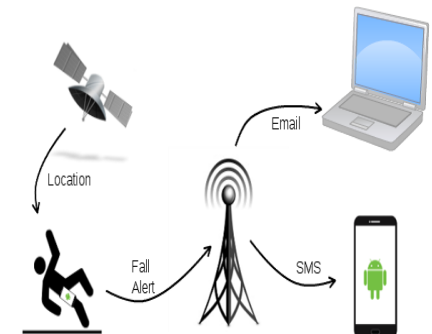- **Fall Detection of Old People:**
  - **Smartphone:**
    - Receives signal from Old People
    - Sends to the Platform
  - **Platform**
    - send notifications to the doctors and users

Spirometer

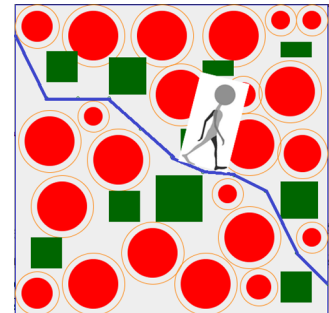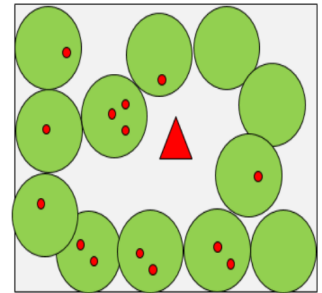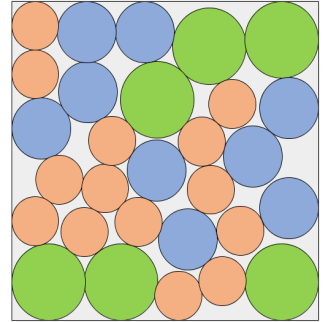**Fall Detection**

2b. Coverage Area (1)

▶ **Area Coverage**
  ▶ In WSN
  ▶ In WSN with Obstacles

▶ **Target Coverage:**

  ▶ Connectivity fault-tolerance for target coverage in WSNs.

  ▶ Connectivity optimization problems in WSNs apply for monitoring the area.

▶ **Barrier Coverage:**

  ▶ Build Intrusion Barrier

  ▶ Find Penetration Path

2b. Coverage Area (2)

- **Area Coverage**
  - Huynh Thi Thanh Binh, Nguyen Thi Hanh, Nguyen Hai Nam, Swarm Optimization Algorithms for Maximizing Area Coverage in Wireless Sensor Networks, SAI Intelligent Systems Conference 2016 (IntelliSys 2016), Sept 2016, London, UK, accepted.
  - Huynh Thi Thanh Binh, Nguyen Thi Hanh, La Van Quan, Nilanjan Dey Cuckoo Search and Flower Pollination Algorithms for Maximizing Area Coverage in Wireless Sensor Networks, Neural Computing and Applications
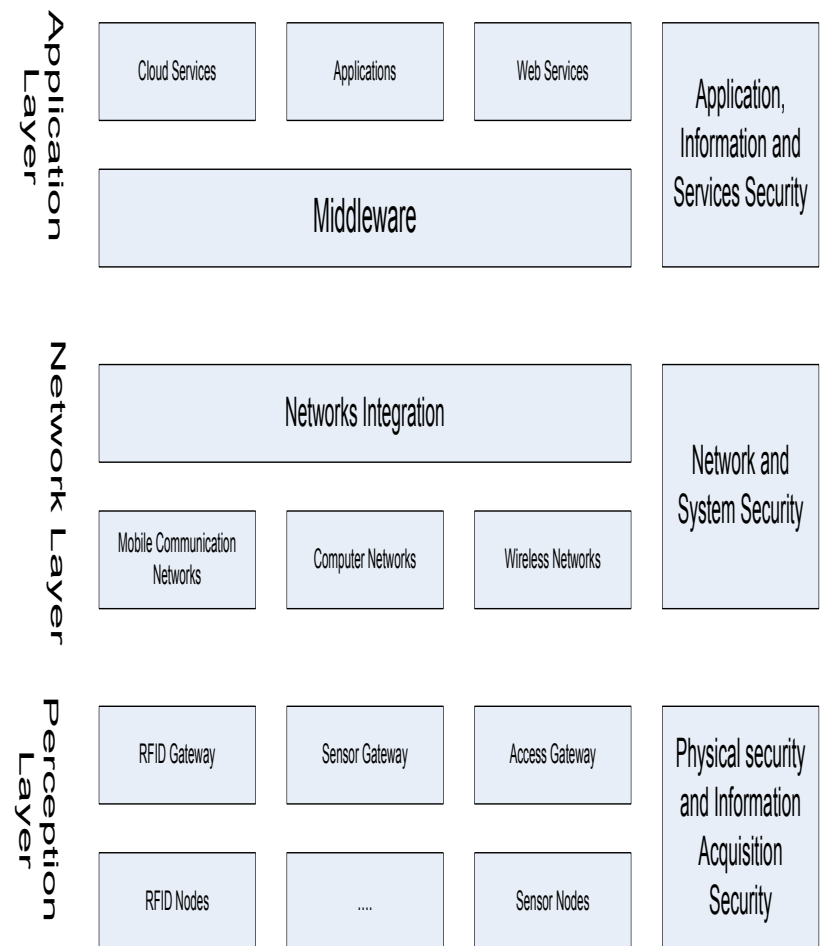
- **Target Coverage:**

  - Nguyen Thi Hanh, Phan Hong Hanh, Huynh Thi Thanh Binh and Nguyen Duc Nghia, Heuristic Algorithm for Target Coverage with Connectivity Fault-tolerance Problem in Wireless Sensor Networks, The 21st Annual Conference on Technologies and Applications of Artificial Intelligence (TAAI), 2016, accepted.

  - Nguyen Thi Hanh, Le Quoc Tung, Nguyen Thanh Hai, Huynh Thi Thanh Binh, Ernest Kurniawan, Connectivity Optimization Problem in Vehicular Mobile Wireless Sensor Networks, Cyberneticscom 2016 - International Conference on Cybernetics and Computational Intelligence, 2016, accepted.

- **Barrier Coverage:**

  - Nguyen Thi My Binh, Nguyen Huy Hoang, Pham Anh Tu and Huynh Thi Thanh Binh, Heuristic Algorithm for finding Maximal Breach Path in Wireless Sensor Networks with Omnidirectional Sensors, HTC 2016

2c. Lightweight Security for Mobile IoT (1)

- **Device and Network Security**
  - Security framework
  - Lightweight encryption – decryption
  - Key management and distribution between sensor and gateway
  - Secure routing
  - Intrusion detection mechanism
- **IoT Gateway and Platform Security:**
  - Data processing centers security
  - Identity authentication
  - Data access control
  - Channel encryption
- **Platform to Cloud security:**
  - Application security
  - Service security
  - Cloud security
  - Privacy protection

Application Layer	Cloud Services	Applications	Web Services	Application, Information and Services Security
	Middleware			

Network Layer	Networks Integration			Network and System Security
	Mobile Communication Networks	Computer Networks	Wireless Networks	

Perception Layer	RFID Gateway	Sensor Gateway	Access Gateway	Physical security and Information Acquisition Security
	RFID Nodes	....	Sensor Nodes	

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2c. Lightweight Security for Mobile IoT (2)

▸ **Solutions:**
  ▸ OpenID and Oauth 2.0 for authentication;
  ▸ PKI based on ECQV (Elliptic Curve Qu-Vanstone) for IoT devices;

▸ **Lightweigt Security:**
  ▸ TLS/DTLS
  ▸ Lightweight authentication
  ▸ Lightweight encryption – decryption

▸ **TLS and DTLS:**
  ▸ Heavyness of handshaking
  ▸ Tiny 3-TLS with ECC
  ▸ Gateway trusted
  ▸ DTLS header compression
  ▸ Using ECC for authentication and key agreement

3. Conclusion and Future Work

▸ **BK-IoT Platform and Applications:**

  ▸ Design of Low Power Low Cost Sensor Hardware for Shirmp Monitoring Farm

  ▸ Energy Efficiency Operating System for IoT

  ▸ Performance Improvement of WSN

  ▸ Commercialization of BK-IoT Platform for monitoring Lung Function Parameters

▸ **Coverage Area:**

  ▸ Area Coverage, Barrier Coverage, Target Coverage

▸ **Security:**

  ▸ Lightweight Security between Sensors and Gateway

  ▸ Multidomain Security for Cloud-centric

Application of IoT application on environmental/pollution monitoring system

1. Haze/smoke monitoring system
2. Noise pollution monitoring system

Transboundary smoke haze problem

- Transboundary smoke haze from land and forest fires during the traditional dry season from June to October has been a perennial problem in the southern ASEAN region in the past decade.

- These fires are caused mainly by land clearing and 'slash and burn' agricultural practices in Indonesia, particularly Sumatra and Kalimantan.

- The resultant smoke haze from such activities can be carried over to Malaysia/Singapore and is dependent on factors such as the proximity and extent of the fires, the strength and direction of the prevailing winds, and the incidence and amount of rain.

Effects

- Transboundary haze pollution affects human health adversely and can also cause significant disruptions to businesses and livelihoods in ASEAN countries, including Malaysia
- Thus, it is important to have a system to monitor the haze level and report it online as the reference value to the
  - Authority to decide on the short term/long term action to be taken
  - Public to adapt/prepare/plan their daily movement accordingly\
- Components
  - Sensors (noise, haze)
  - Gateway
  - Middleware IoT Cloud by Mi-MIST
  - Application (visualization in webapps and mobile apps)

Mobile IoT Architecture

Application Layer

To collect and store the data in Database
Analyze the data for the visulization

MIST
MIMOS Internet Services of Things

Connectivity Network Layer

- Wired and wireless connectivity
- Edge middleware
- Pervasive network

Environmental Sensor (& Actuator) Layer

- Sensors & actuators
- Embedded middleware
- Mobile devices

Mi-MIST IoT Platfrom