

Project Report

Project Time:

- From April 2017 to April 2019 (24 months)

Project Members:

- **PTIT (Vietnam):** Prof. Hai (05 others: Dr.Minh, Dr.Dau, MSc.Thang, Dr.Duy,...)
- **NECTEC (Thailand):** Dr. Chalee (others: MSc.Ekkachan, Mr. Phitak,...)
- **MIMOS Bhd (Malaysia):** Dr. Choong (others: Dr. Kok, Mr. Chrishanton,...)
- **HUST (Vietnam):** Prof. Thu
- **NUCE (Vietnam):** Dr. Nga (5 others: MSc. Phong, MSc. Nguyet, MSc.Duong, Msc. Thuy Duong, MSc. Quang,...)
- **NICT Security Labs (Japan):** Dr. Ryoichi (invited advisors: Dr. Takahashi, Dr.Inoue)
- **NES /NEC (Japan):** Dr. Tamoyuki Kuroda

Presented by:

Dr. Chalee Vorakulpipat

Assoc.Prof. Dr.Sc. Hoang Dang Hai

Jakarta, Indonesia, 27.11.2018

Summary of desired Scientific Goals

• Hybrid Security Framework for IoT Networks

- 1- Secure Fog architecture
 - Security Level assignment for Fogs perimeters, devices
 - Mapping mechanism for IoT Fogs
- 2- Lightweight secure data acquisition/transmission
 - Secure data acquisition (encryption)
 - Secure transmission (identity authentication)

• IoT Network Monitoring

- 1- A NICTER/NETPIE Platform for IoT Monitoring, detection of attacks
- 2- Watermarking for network
- 3- Building attack dataset

• Development of case-study

- 1- A Multimedia IoT Gateway platform for secure cross-platform screen sharing (Smart Office)
- 2- IoT device authentication (using MAC address), Identity Authentication
- 3- Test-bed for secure IoT data collection (example of Vehicle traffic data acquisition).

Research Outcome:

1. Achieving research results for scientific goals.
2. Publishing common papers
3. Creating links between researchers / institutions
4. Exchanging researchers, sharing expertise knowledge between project members
5. Contribution to technology push / market pull development and promoting ASEAN IVO research results

Project Results

Research Results

Common Papers

Joint Activities

Exchange Prog.

Other issues

1- IoT security framework / monitoring system:

1.1. A modelling framework for security assessment using system theory:

- Secure state = stable system state. Vulnerable states = unstable states

1.2. A comprehensive Survey on IoT security issues

- Recent challenges, trends, concerns related to IoT security. IoT security generations, cloud-based centralized approach.

1.3. Setting up and Study monitoring network with NICTER/NETPIE

- Installation, setting up NICTER/Daedalus and NETPIE IoT test platform.
- Study on IoT connection to WiFi networks. Monitoring & detection malware.

1.4. Design and computation of a monitoring network for IoT

- Design a hierarchical architecture for monitoring/detection using 2 levels (Fog, Cloud). Computation of system parameters (processing, storages).

1.5. Design of security levels priority, mapping mechanism

- Classification of security levels with weights (priority level). Development of mapping mechanism.

1.6. Study and experiments with IoT incident collection

- Study on Honeypot, incident signature

Project Results

Research Results

Common Papers

Joint Activities

Exchange Prog.

Other issues

2- Security Monitoring and Detection

2.1. Methods for detecting anomalous IoT network traffic

- Principal Component Analysis (PCA) for data dimension reduction.
- Building attributes for abnormal features. Detection method development.

2.2. Methods for IoT device identification and authentication

- Study on device Motion, building model for device identification & authentication
- Usable & secure authentication scheme using cloud-based biometrics.

2.3. Proposal for lightweight secure transmission between IoT devices

- Study & experiments of RSA, ECC encryption scheme for transmission.

2.4. Attack dataset classification

- Study on attack incident collection & big dataset clustering.

3- Development of wireless presentation sharing system using IoT gateway

3.1. Design of IoT gateway for presentation sharing

- Development of wireless sharing mechanism.

3.2. Method for secure authentication for presentation sharing using biometric (facial image)

- Flow control method for presentation sharing with presenter faces.

3.3. Method for device authentication using watermarks

Project Results

Research Results

Common Papers

Joint Activities

Exchange Prog.

Other issues

1- IoT security framework / monitoring system:

1.1. Paper 1: *“A security assessment approach based on system theory”*.

Workshop in University of Crypto-Techniques, Hanoi, Nov. 2017.

1.2. Paper 2: *“Recent Challenges, Trends and Concerns related to IoT security: An evolutionary study”*.

Proc. of IEEE ICACT, Korea, Feb. 2018. Best paper Award.

1.3. Paper 3: *“Security Monitoring of IoT networks”*.

Journal of Science and Technology on Information & Communication, PTIT, Vol. 1, No. 1&2, Apr. 2018.

1.4. Paper 4: *“Evaluating the security levels of the Web-portals based on the standard ISO/IEC 15408”*.

Proc. of IEEE Intl. Symposium on Information and Communication Technology, (SoICT 2018) Da Nang, Vietnam, Dec. 2018 (accepted).

Project Results

Research Results

Common Papers

Joint Activities

Exchange Prog.

Other issues

2- Security Monitoring and Detection

2.1. Paper 5: *“A PCA-based Method for IoT Network Traffic Anomaly Detection”*.

Proc. of IEEE ICACT, Korea, Feb. 2018. Best paper Award.

2.2. Paper 6: *“Detecting anomalous network traffic in IoT networks”*.

Journal, Transaction on Advanced Communication Technology (TCACT), 2018.

2.3. Paper 7: *“A study on the sensor network authentication by utilizing a Brownian motion behavior”*.

Proc. of IEEE ICTC 2017, Korea, Oct. 2017.

2.4. Paper 8: *“A secure authentication scheme based on Brownian motion in the multi-hop wireless sensor networks”*.

Journal of IET Communications (submitted).

2.5. Paper 9: *“Usable and secure Cloud-based biometric authentication solution for IoT devices”*.

Proc. of IEEE Symposium on Computers and Communications, Brazil, June 2018.

Project Results

Research Results

Common Papers

Joint Activities

Exchange Prog.

Other issues

3- Development of wireless presentation sharing system using IoT gateway

3.1. Paper 10: *“Automated Wireless Presentation System with Facial Images”*

Proc. of IEEE Intl Conference on Automatic Control and Intelligent Systems, (I2CACIS 2018), Shah Alam, Malaysia, Oct. 2018.

3.2. Paper 11: *“A novel fuzzy inference system based on Hedge Algebras to enhance energy efficiency in wireless sensor networks”*

IEEE 3rd Intl Conference on Communication and Information Systems (ICCIS 2018), Singapore, Dec. 2018 (accepted).

4- Survey Report to NES in December 2017, March 2018

Project Results

Research Results

Common Papers

Joint Activities

Exchange Prog.

Other issues

- **Kick-off meeting: 25 July, 2017, Hanoi, Vietnam**
 - All project members: 2 NICT Japan, 2 NECTEC Thailand, 2 MIMOS Malaysia, 10 from PTIT, HUST and NUCE Vietnam.
 - Overview of project, plan, work packages
 - Budgetary and legal guideline, project procedure
- **Joint workshop: 25-26 July, 2017, Hanoi, Vietnam**
 - Invited presentation by Dr. Takeshi Takahashi (NICT): *“Monitoring system with NICTER / Daedalus”*.
 - Project presentation (objectives, system architecture, proposals)
 - Presentations of project members (NECTEC, MIMOS, HUST, NUCE, PTIT)
 - Discussion for work packages, deliverables of each team, timeline planning
 - Discussion for research cooperation issues
- **Meeting with NES (NEC Japan): 26 Sept. 2017, Hanoi**
 - Presentation of project contents and joined work.
 - Discussion for cooperation with NES
 - NES is a project member (Dr. Tamoyuki Kuroda)

Project Results

Research Results

Common Papers

Joint Activities

Exchange Prog.

Other issues

- **Joint workshop: 11 September, 2017, Bangkok, Thailand**

- Joint NECTEC-NICT Workshop at NECTEC Annual Conference.
- NICT Cybersecurity Lab (CSL) presented NICTER/Daedalus and NECTEC presented IoT Security.
- Dr. Takahashi and two engineers (NICT) visited NECTEC and installed NICTER at NECTEC between 2-3 August 2017.
- Discussion about ongoing results and further activities.

- **Joint workshop: 15 Dec. 2017, Hanoi, Vietnam**

- Researchers of PTIT, NUCE, HUST discussed on joint research topics.

- **Other joint activities**

- 02 researchers of NECTEC joined Network Security Workshop at NICT in Sept 2017.
- 04 researchers of PTIT, NUCE joined Security Workshop in Hanoi, Oct. 2017.
- 01 researcher of NUCE joined Network Security Workshop at NICT in Japan, Oct. 2018.

Project Results

Research Results

Common Papers

Joint Activities

Exchange Prog.

Other issues

- **Research Exchange:**

- 02 researchers of NECTEC visited NICT Lab on 25-27th Sept 2017 (NECTEC budget).
- 01 researcher of NUCE joined an internship program 01 month at NICT in Japan, 01st Oct. to 05th Nov. 2018 (IVO project budget).

Project Results

Research Results

Common Papers

Joint Activities

Exchange Prog.

Other issues

- **Equipment issues:**

We use of some existing devices from other projects (Arduino kit, XBee devices, Libelium platform, NETPIE platform, RecoMedia server platform, some camera sensing devices, etc.) for doing research and experiments.

The existing devices are not enough for building necessary fogs for investigation on communication between fog and fog, between fogs and the cloud. Dedicated server for data collection and processing is needed.

We applied for equipment support, and waiting for the approval from NICT now.

Project Progress

- **Project Begin:** 01 April 2017. **Project End:** 01 April 2019 (24 months).
- **Work done:**

No	Item	Time	Status
1	Preparing work	Apr. – July 2017	Done
2	Kick – off meeting	July 2017	Done
3	Research work on assigned items to different project teams	July 2017 - Now	Almost completed
4	Labs preparation for experiments	Nov. 2017 – Now	Partly completed (Just used existing devices for experiments. Limited configuration & architecture)
5	Workshop / Seminars	July 2017 - Now	Organized 03: done. (01 for all in 07/2017, 01 of NECTEC & NICT in 09/2017, 01 of PTIT, NUCE, HUST in 12/2017). Attended: 03

Project Progress (continue)

- **Project Begin:** 01 April 2017. **Project End:** 01 April 2019 (24 months).
- **Work done:**

No	Item	Time	Status
6	Common papers	Apr. 2017 - Now	10 published. 02 will be published in Dec.2017
7	Reports	Apr. 2017 - Now	03 temporal reports 01 Survey report for NES
8	Research exchange	July 2017 - Now	02 researchers of NETEC at NICT for 02 days (NETEC budget) 01 researcher of NUCE at NICT for 01 month

Project Progress (continue)

- **Project Begin: 01 April 2017. Project End: 01 April 2019 (24 months).**

The purchase of equipment has some difficulties and postponed.
We expect to apply for an extension of 6 months for the project.

- **Work to be done:**

- Expected Approval of NICT for equipment.
- Purchase of equipment.
- Setting up equipment. Making further experiment and evaluation.
- Further paper publication.
- Project Final report and closing.

Thank you !

Any questions ? to Presenters:

Dr. Chalee Vorakulpipat, NECTEC

Assoc.Prof. Dr.Sc. Hoang Dang Hai, PTIT