



Enable Heterogenous Open Data with Internet-of-Things

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Use Cases and Data Production Players

Proposed Use cases for Data Production Project and Its Ecosystem

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Digital Technology**



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- Open Data is the concept where data is openly available and accessible by everyone in which case showing transparency and accountability.
 - It has the potential to open minds and transform societies, as reported by Advocates for International Development.
 - However, it is once reported by **OpenDevelopment Cambodia**, that there is a high demand for Open Data Consumption in Cambodia however, it is struggling due to low availability and the number of data producers.

With very little data production, How can Internet-of-Things can join to push the production of heterogeneous open data for Cambodia?



Fundamental of IoT

What is Internet-of-Things?

Internet-of-things enables the objects to gather and exchange information based on the communication protocols which creates opportunities for more direct integration between the physical and virtual world. The networked interconnection of heterogeneous objects from both worlds is then exploited to capture miscellaneous data and perform an analysis to benefit our life.

Internet of Things - Architecture, Interoperability and Use Case for Agriculture in Cambodia

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Abstract:

It has been shown that Internet of Things (IoT) is one of the top trending technologies where it has been implemented in various sectors. IoT is the concept of interconnection between heterogeneous devices so that different intentions can be achieved, either to monitor or to automate. This paper is intended to introduce IoT-based technology thoroughly by pointing out its definition, purpose and architecture as well as how it interoperates. More importantly, displaying IoT in agriculture which illustrates why the integration of IoT into agriculture in Cambodia is needed. Looking out of Cambodia, AgriTech has been introduced throughout the world, in the meantime, of agricultural development, it has seen a slow increment due to land expansion which to produce more results is no longer the solution. IoT will be the key technology to improve productivity, thus increasing the outcome. There are five IoT use cases proposed in this paper to solve different problems of AgriTech in Cambodia from Farming to Fisheries and Aquaculture.

Keywords: Internet-of-Things (IoT), smart agriculture, crop management, aquaculture, livestock monitoring, fertigation, crop disease management, agricultural drones.

I. Introduction

Internet-of-things is the concept that enables the objects to gather and exchange information based on the communication protocols which creates opportunities for more direct integration between the physical and virtual world. The networked interconnection of heterogeneous objects [1] from both worlds is then exploited to

capture miscellaneous data that perform an analysis to benefit our life.

The intention to have IoT system is diverse however two main motives behind any innovation are usually to monitor and control or automate. Below illustrates the meaning of each purpose.

Monitoring

Monitoring is the systematic procedure of gathering, analyzing and using acquired information to reach a suitable conclusion. Thus, IoT monitoring is not much different; its purpose is to put together those data from remote sensors, study and explore, and elaborate information to provides insights, flag any events or alerts of any problems occurring and suggests the proper actionable solutions which can be beneficial any sector.

In agriculture, the real-time data that has been collected, enables farmers and growers to monitor their crop, livestock and other activities from distance which reduce lots of man power activities actually keep checking for that information manually.

Automation

From the collected data, the users are not only able to monitor remotely, but also to automate most of the repetitive tasks that involve human interaction as well.

For example, a smart irrigation system: when the data shows that the soil is dry, it will take an autonomous action by watering until it reaches the moisture level that the soil needs.

IoT solutions have been implemented into agriculture with the same purpose. It has

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manages, processes and integrates those data. In this layer, data will be saved in a data storage or on a cloud server and other actions will be taken. For example, information processing, data analytics and cloud computing.

Lastly, those data will be used in a smart application and displayed in an interface chosen specifically for its users in the application layer. It can be a dashboard, web application or mobile applications. The example of smart applications includes water monitoring and controlling and others.

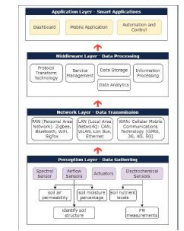


Figure 1. IoT Fundamental Architecture and Interoperability

IV. Use Cases for Agriculture in Cambodia

Agriculture has always been playing an important role in the growth of Cambodia's GDP with an average of around 50% during 2000 to 2014 and estimated at 22.1% in

2019. Crop production has the largest output contribution in total national GDP at 13%, followed by fisheries 5.5%, livestock 2.6% and others[7]. This has proven that technology innovation should be introduced to improve the agriculture.

These are the 5 use cases of IoT technology that we recommend for the agricultural sector in Cambodia.

Fertigation

Fertigation technology [8] is recognized as a new agricultural technology with high-efficiency water and fertilizer control, it solves the problem of crop yield and quality. Thus, it solves the problem of plant's nutrient deficiencies as well.

The method is to inject fertilizers within the irrigation water. With IoT sensors, real-time soil moisture information will be transmitted and the fertigation process will be automated. It will release the amount of water and fertilizers to which it is needed on the field.

Livestock Monitoring

To improve the way farmer, monitor their livestock, IoT brings the possibilities to optimize livestock health using remote monitoring and data-driven decision making. Farmers now can monitor the health level, reproductive cycle, and track livestock location with less human labor.

IoT solutions use wearables mounted on the animals[9]. The built-in sensors help to capture data like heart rate, respiratory rate, blood pressure, digestion level, and other vitals. The provided data also includes the location of each livestock and can be used to measure when it goes into heat as well.

Agricultural Drone

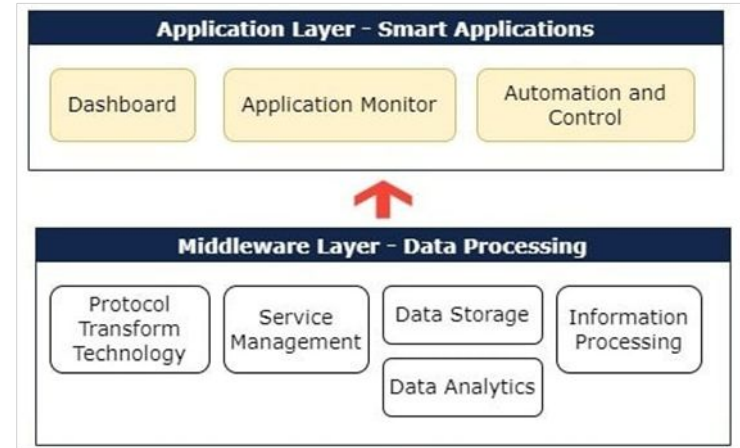
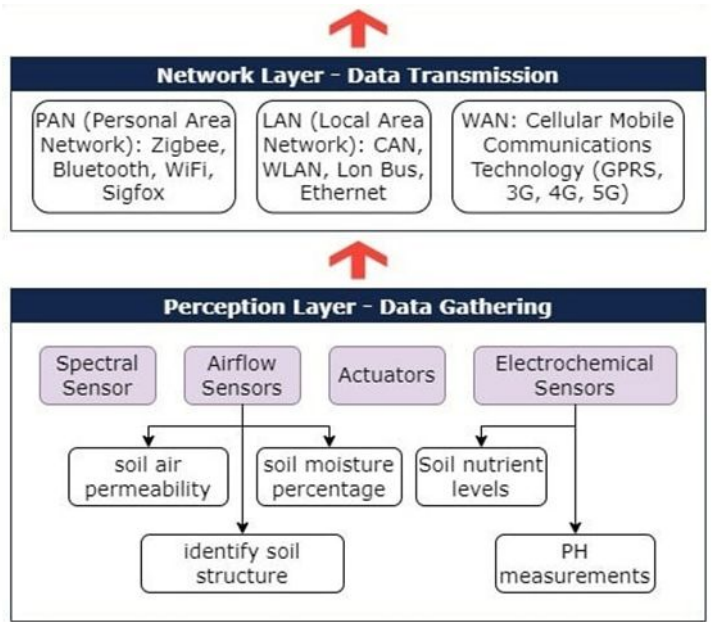
Drones equipped with several sensors [10] that can be used to monitor crop conditions and diseases, plant health indicators,

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Fundamental of IoT

Internet-of-Things - Interoperability and its Components



Fundamental of IoT

Internet-of-Things - Example Applications

Internet of things - Use Cases for Agriculture in Cambodia

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Abstract

In 2020, the share of agriculture in Cambodia's Gross Domestic Product was 22.38 percent. This indicates the importance of the sector to the economy and technology advancement is needed to improve both yield and productivity. In this paper, 5 IoT use cases are proposed which includes fertigation, livestock management, aqua farming, agricultural drone and crop disease management. These technology allows farmers to monitor their product remotely, automate most of the repetitive tasks and to increase product yield and quality.

Fertigation

Fertigation technology is recognized as a new agricultural technology with high efficiency water and fertilizer control. It improves both crop yield and quality.

The method is to inject fertilizers within the irrigation water. With IoT sensors, real-time soil moisture information will be transmitted and the fertigation process will be automated.



Figure 1: Fertigation, January 18 2022. (Source: Cropaia, 2022:Online)

Livestock Monitoring

IoT brings the possibilities to optimize livestock health using remote monitoring and data-driven decision making. Farmers are able to monitor the health level, reproductive cycle, and track livestock location with less human labor.

IoT solutions use wearables mounted on the animals. The built-in sensors help to capture data like heart rate, respiratory rate, blood pressure, digestion level, and other vitals. The provided data also includes the location of each live-

stock and can be used to measure when it goes into heat as well.



Figure 2: IoT wearable sensors on cattle, March 01 2018. (Source: NTT TechnoCross, 2018:Online)

Aqua Farming

Water quality influences feed effectiveness, development rates and in general wellbeing status of the fish. It is dictated by factors, for example, temperature, turbidity, carbon dioxide, pH, smelling salts and so forth.

Sensors are used to measure those data in real-time, so that farmers can monitor the fish pond remotely and also automate the feeding system as well.



Figure 3: eFishery fish feeding, August 2021. (Source: mime.asia, 2021:Online)

Agricultural Drone

Drones equipped with several sensors that can be used to monitor crop conditions and diseases, plant health indicators, vegetable density, pesticide prospecting, fertilizers, plant height measurement, field water mapping and many other utilities. It is considered to be a very advantageous technology.

Although agricultural drones have many benefits, there are significant challenges in the implementation process due to its cost and the limitation in the operating process (short time performance and affected by climatic conditions, rain and extreme heat).



Figure 4: Agricultural Drone, October 26 2020. (Source: asi-atimes.com, 2020:Online)

Crop Disease Management

In 2016 and 2017, the outbreak of cassava mosaic disease posed a threat to Cambodia's cassava sector which reduced yields by up to 80 percent. This has resulted in a big loss to farmer's income and highly affected Cambodia's economy.

To recognize plant diseases before they spread bigger, IoT solutions have been proposed and implemented. Diseases can be detected with the change of leaf condition using sensors [13], it gathers information such as temperature, moisture and shade of plant leaves. With machine learn-



Figure 5: crop disease analyzing parameters, February 14 2022.

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Fundamental of IoT

Internet-of-Things - Motives

The goal behind the internet-of-things is to improve efficiency, report information in real-time and bring it to the surface more quickly than a system depending on human intervention. That's why it has been divided into two main purposes when IoT is implemented; monitoring and automation.



IoT for Data Production

Classical Method To Data Collection

- Quantitative face-to-face (F2F) research
- Qualitative research – Focus Groups
- Qualitative Research – In-depth Interview
- Platform Base - Social Media
- Transactional Data - From Using services
- Other Different Methods



IoT for Data Production

Problem to Classical Method

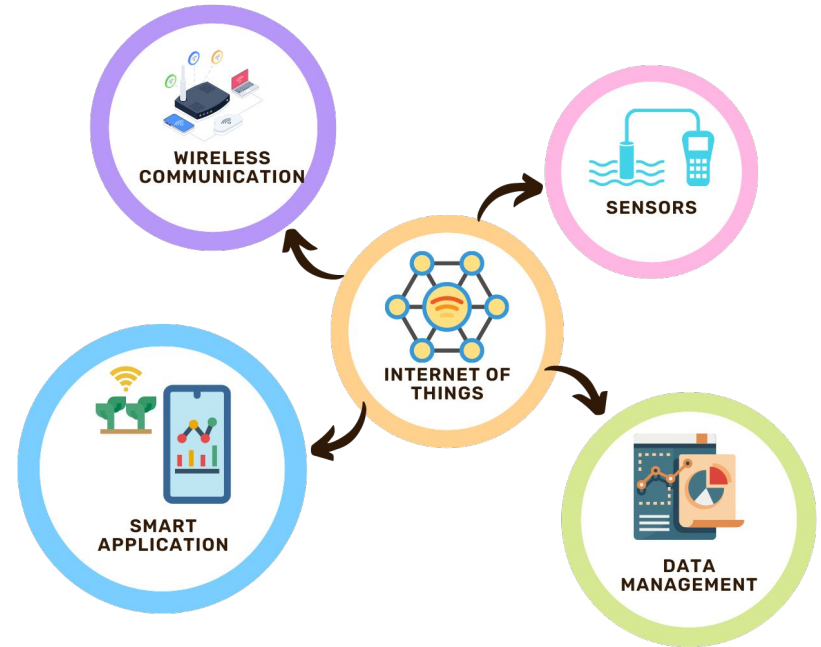
- Untrustworthy - Outlier
- Unorganized
- Private Data - Sensitive Data
- Service base
- Guessing Work
- Other Problems



IoT for Data Production

How IoT comes to play?

- Accuracy - No Guessing Work
- Heterogeneous Data - Different Type of Sensors
- Huge Amount of Data - Big Data
- Digitalize and Automate Storing Process - Communication Technology and Cloud Platform
- Easily Configurable Accessibility



Data Products for Disaster Prevention

Real Use Case Project of CADT, KMITL and Others

GNSS and Ionospheric Data Products for Disaster Prevention - Collaboration Project between KMITL and CADT

The project is done and funded under ASEAN IVO.

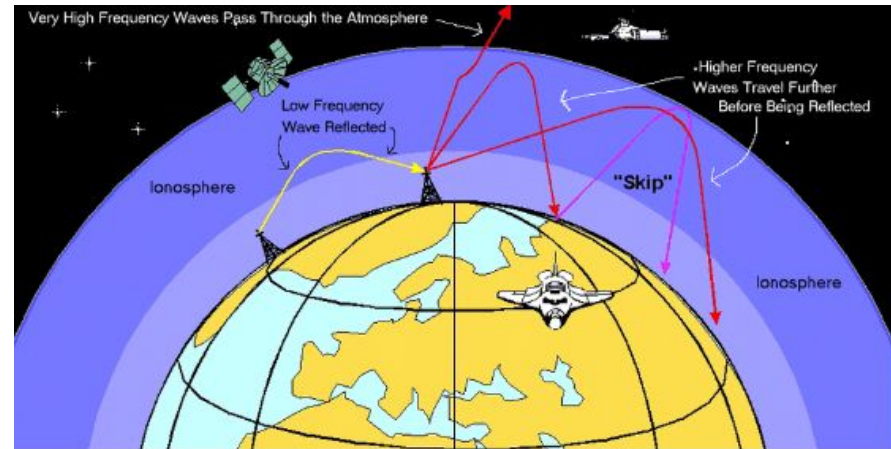
4	<u>GNSS and Ionospheric Data Products for Disaster Prevention and Aviation in Magnetic Low-Latitude Regions (Phase II)</u>	2021/4 – 2023/3	Lin Min Min Myint KMITL(THA)	CMU(THA), GISTDA(THA), NUOL(LAO), CADT(KHM), NICT(JPN)
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Data Products for Disaster Prevention

GNSS and Ionospheric Data Products for Disaster Prevention

The ionosphere in the magnetic low-latitude and equatorial regions is known to be highly variable due to unique disturbance events. Ionospheric irregularity often leads to degradation in performances of communication and navigation.

Knowledgeable in understanding space weather parameters and levels, and observations of local conditions need to be continuously monitored



Data Products for Disaster Prevention

GNSS Receiver Installation at CADT



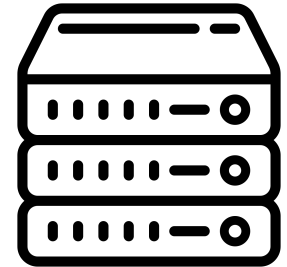
Antenna (on Rooftop)



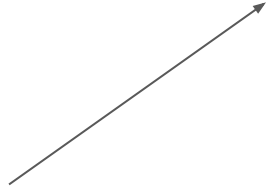
Receiver (In Server room)



Computer (In Server Room)

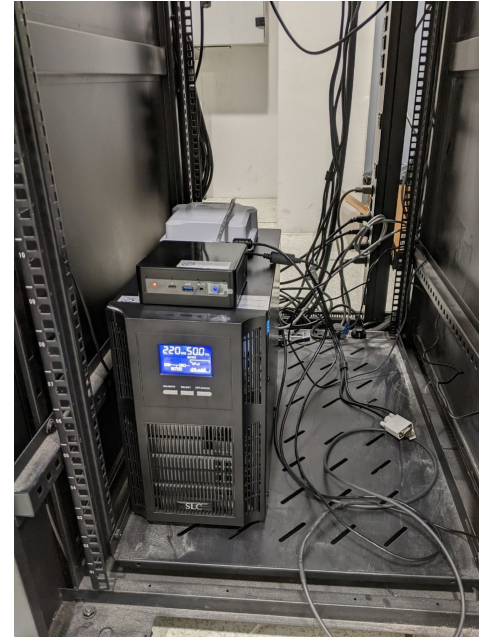


KMTL Server (Thailand)



Data Products for Disaster Prevention

GNSS Receiver Installation at CADT



Data Products for Disaster Prevention

Open Data for Research Purpose



The screenshot displays the website for the Thai GNSS and Space Weather Information Data Center. The navigation menu includes HOME, OBSERVATION, SERVICES, RESEARCH, RESOURCES, and ABOUT US. The main heading is 'THAI GNSS AND SPACE WEATHER' with the subtitle 'THAI GNSS AND SPACE WEATHER INFORMATION DATA CENTER'. The 'Research' section is highlighted, featuring a 'Current Projects' list with two entries: 'GNSS and Ionospheric Data Products for Disaster Prevention and Aviation in Low-Latitude Regions (Apr 2019 – Mar 2021) – ASEAN IVO Project' and 'Ionospheric Observation and GPS Monitoring in Thailand (Mar 2017 – Mar 2022) – NICT(Japan)'. A 'MAIN MENU' sidebar on the right lists Home, Observation, Solar Activity, Space Environment, and Ionosphere and GNSS.

HOME OBSERVATION SERVICES RESEARCH RESOURCES ABOUT US

THAI GNSS AND SPACE WEATHER
THAI GNSS AND SPACE WEATHER
INFORMATION DATA CENTER

Research

Current Projects

1. GNSS and Ionospheric Data Products for Disaster Prevention and Aviation in Low-Latitude Regions (Apr 2019 – Mar 2021) – ASEAN IVO Project
2. Ionospheric Observation and GPS Monitoring in Thailand (Mar 2017 – Mar 2022) – NICT(Japan)

MAIN MENU

- Home
- Observation
- Solar Activity
- Space Environment
- Ionosphere and GNSS

http://iono-gnss.kmitl.ac.th/?page_id=3391

Use Cases and Data Production Players

Different Possible Use Case

- User Reported Application
- Skill-base Survey Platform
- Satellite Image - Agricultural Data Production
- Greenhouse Gas Emission in Campus/ Regional/ Country
- Utilities Data Production



Use Cases and Data Production Players

Data Production Key Player



- Development Partners
- Technical Partners - Implementers
- Local Research and Innovation Center
- Educational Institutions
- Government

Conclusions and Suggestions

- Open Data will be the opened door to various stakeholders from ministries, organizations, institutions as well as individual researchers which allow them to acquire critical information.
- Yet, it is once reported by OpenDevelopment Cambodia, that there is a high demand for Open Data Consumption in Cambodia however, it is struggling due to low availability and the number of data producers.
- Let's bring together all the stakeholders, to produce more data which lead to more insight and more innovation

Information is everything!

The background features abstract, organic shapes in shades of purple and orange. A large, light purple shape is on the left side, and smaller purple and orange shapes are scattered in the top right and bottom right corners. The text "Thank you!" is centered in a bold, dark blue font.

Thank you!