

# Visual-Peat: Adoption of technology in the mitigation of peatland forest fire in ASEAN

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**Country Lead for Brunei: NAPC 2018 - 2021 & Net Peat 2022**

**(Need to Expand these projects to ensure sustainable social innovation with our respective stakeholders)**



**WORK TOGETHER FOR THE COMMON GOAL**

**“Alone we go fast, together we go far”**

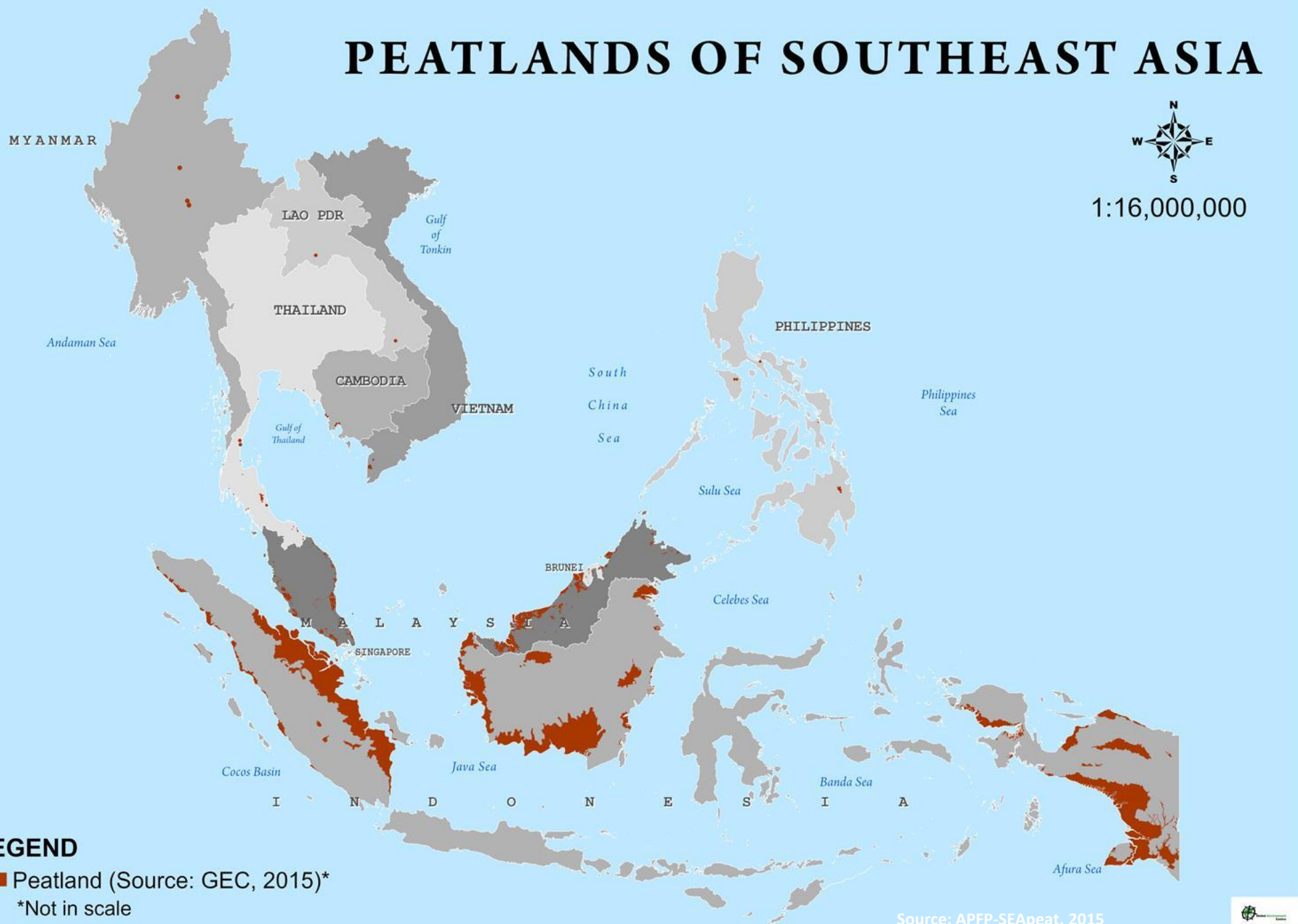
**THANK YOU**

**Any Questions**

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# PEATLANDS OF SOUTHEAST ASIA



**Total  
estimated  
peatland areas  
of 23 million ha**

Country	Hectare
Brunei Darussalam	90,900 <sup>a</sup>
Cambodia	9,850 <sup>b</sup>
Indonesia	20,200,000 <sup>c</sup>
Lao PDR	1000 <sup>b</sup>
Malaysia	2,560,341 <sup>d</sup>
Myanmar	11,233 <sup>e</sup>
Philippines	20,188 <sup>e</sup>
Thailand	64,555 <sup>e</sup>
Viet Nam	24,000 <sup>e</sup>
<b>TOTAL</b>	<b>22,982,067</b>

Sources:

a – National Action Plan on Peatland, 2014

b – SEApeat reports, 2015

c – CIFOR, 2018

d – DOE, 2019

e – AMS, 2020



## LEGEND

 Peatland (Source: GEC, 2015)\*

\*Not in scale

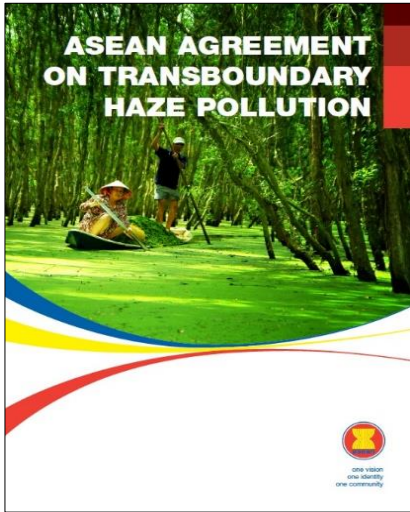


# More than 5 million ha of peatlands have burnt in last 20 years

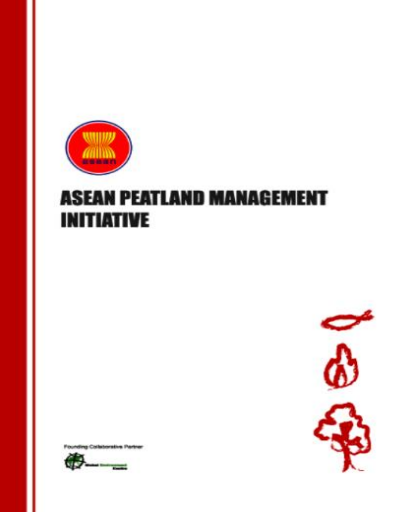
## 70% of peatlands have been degraded in the past 40 years



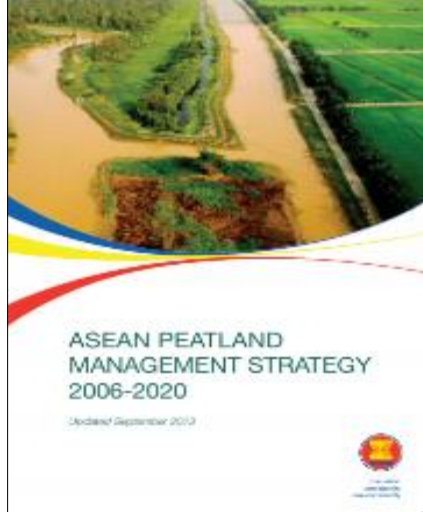
### ASEAN Policy Framework Guidelines and Key Achievements to address Peatland issues



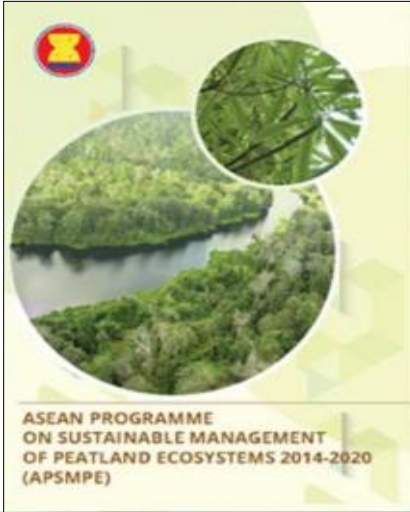
ASEAN Agreement on Transboundary Haze Pollution (AATHP) 2002



ASEAN Peatland Management Initiative (APMI) 2003



ASEAN Peatland Management Strategy 2006-2020 (APMS)



ASEAN Programme on Sustainable Management of Peatland Ecosystems 2014-2020 (APSMPE)



APRP-SEAPEAT Key Achievements (2010-2015)



ASEAN Guidelines on Peatland Fire Management (2016)

# Original Peatland vs Degraded Peatland

- Peatland – good source of carbon
- Naturally can guard itself against fire and drought unfortunately when the eco system is disrupted it no longer can sustained this property
- Once fire break-out, an amount of carbon is released
- As the eco-system disrupted natural source of water is no longer available
- To get to the location is also difficult
- In densely peat forest, to bring in the water source to kill the fire will be tedious and an expensive task
- For eg: Brunei in 2016, spend US\$5.6Millions to water bomb the affected area (BFRD, 2016)

## Peatland management issues in ASEAN

- Over-exploitation of forest resources
- Large scale agriculture, oil palm and forest plantation development
- Peat over-drainage and subsidence
- Peatland fires and associated smoke haze
- Fragmentation and disruption of peatland landscapes
- Loss of peatland biodiversity
- GHG emissions and climate vulnerability





Dry

# Outcomes of low and high peatland water level

Wet



**BFRD killing out fire in one of the peatland fire incidents**



## Fire suppression methods

• “Total Flooding”

• Water Bombing

- Make a fire break/temporary lake or pool
  - Slow down the spread of the fire
  - Easily access by firefighters
  - Minimise the fire damage





# ASEAN IVO 2018 -2021: Smart Environment (NAPC)

Indonesia

Malaysia

Brunei

**NAPC: Networked ASEAN Peat Swamp Forest Communities**

ict Virtual Organization of ASEAN institutes and NICT

ASEAN IVO NICT Japan

Badas, Brunei

Jambi, Indonesia

Raja Musa Forest Reserve, Malaysia

Project Leader:  
**Universiti Putra Malaysia**  
USD 76,000  
(1/7/2018 – 30/6/2020)

13 CLIMATE ACTION  
14 LIFE BELOW WATER  
15 LIFE ON LAND

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JARATAN METEOROLOGI MALAYSIA

MYCUACA v2.0

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Maklumat Cuaca Kini di Hujung Jari Anda

Temperature: 30.64

Humidity: 71.03

Temperature Chart

Humidity Chart

Weather Monitoring Panel



# Social Innovation: Important to Engage with Stakeholders and Collaborators, Thus need to sustain



## Develop Biodiversity Action Plan



## Develop Fire Communication Plan



## Stakeholder Involvements



- AITI – Signing in April 2019
- DST - Internet connectivity
  - DST have agreed to sponsor for connectivity VIA sim.
  - Sign 28<sup>th</sup> August 2019
- ANIAN – LoRA Gateway & knowledge transfer
  - Sign MOU with ANIAN –LORA
  - 26<sup>th</sup> September 2019



## Conservation by Tree Planting



## Implementation Plan for restoring degraded areas



جاڤز ڪاڄي چولچا پروني دارالسلام



Singapore-MIT Alliance for Research and Technology



## List of Publications:


# Peatlands Monitoring in Malaysia with IoT Systems: Preliminary Experimental Results (CIIS 2020) IoT Initiative in Malaysia for Forest Fire Monitoring, (INTROPica Highlights)

[International Conference on Computational Intelligence in Information System](#)

CIIS 2018: [Computational Intelligence in Information Systems](#) pp 157-167 | [Cite as](#)

## Towards Developing a Peatland Fire Prevention System for Brunei Darussalam

Authors [Authors and affiliations](#)

Nurul Wardah Haji Hamzah , Siti Aisyah Haji Jalil , Wida Susanty Haji Suhaili 

Conference paper

First Online: 18 October 2018

221

Downloads

Part of the [Advances in Intelligent Systems and Computing](#) book series (AISC, volume 888)

Conference Paper


## IoT-Based Environmental Monitoring System for Brunei Peat Swamp Forest


September 2020


DOI: [10.1109/ICOSICA49951.2020.9243279](https://doi.org/10.1109/ICOSICA49951.2020.9243279)


Conference: 2020 International Conference on Computer Science and Its Application in Agriculture (ICOSICA)

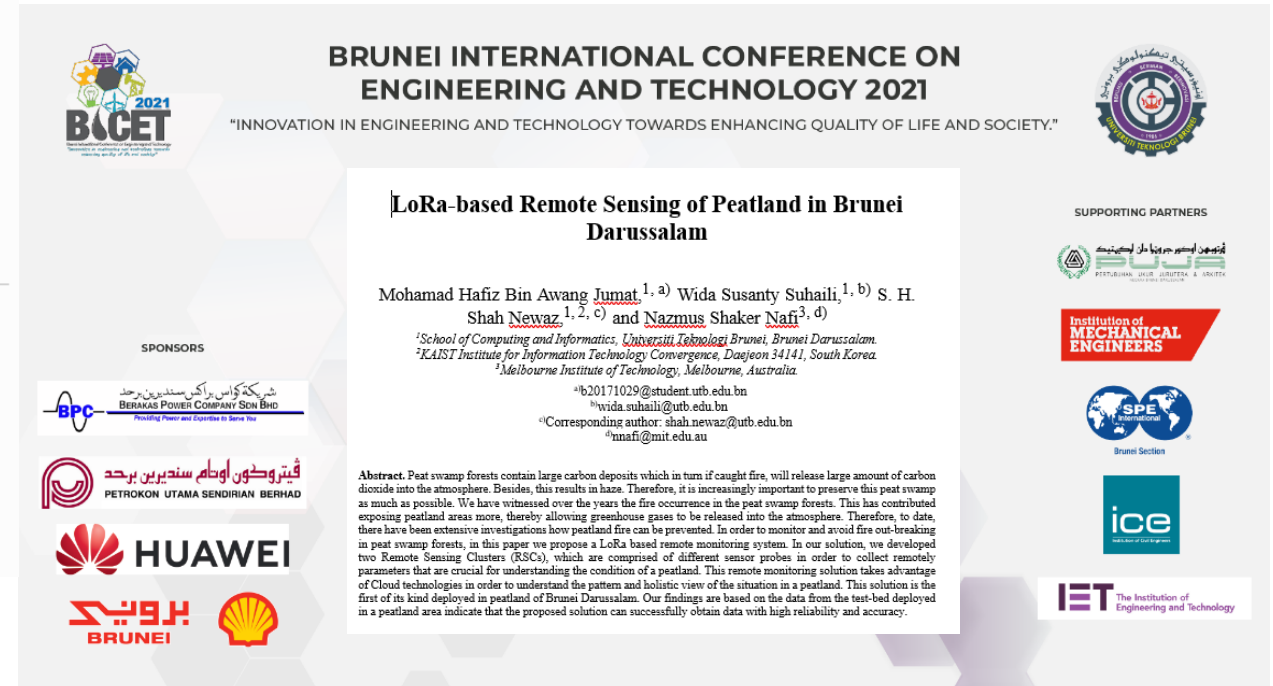
Authors:

 Syazwan Essa

 Rafidah Petra

 Mohammad Rakib Uddin  
Universiti Teknologi Brunei

 Wida Susanty Haji Suhaili



**BRUNEI INTERNATIONAL CONFERENCE ON ENGINEERING AND TECHNOLOGY 2021**  
"INNOVATION IN ENGINEERING AND TECHNOLOGY TOWARDS ENHANCING QUALITY OF LIFE AND SOCIETY."

**LoRa-based Remote Sensing of Peatland in Brunei Darussalam**

Mohamad Hafiz Bin Awang Jumat<sup>1, a)</sup>, Wida Susanty Suhaili<sup>1, b)</sup>, S. H. Shah Newaz<sup>1, 2, c)</sup> and Nazmus Shaker Nafi<sup>3, d)</sup>

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<sup>2</sup>KAIST Institute for Information Technology Convergence, Daejeon 34141, South Korea  
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<sup>d)</sup>nafi@mit.edu.au

**Abstract.** Peat swamp forests contain large carbon deposits which in turn if caught fire, will release large amount of carbon dioxide into the atmosphere. Besides, this results in haze. Therefore, it is increasingly important to preserve this peat swamp as much as possible. We have witnessed over the years the fire occurrence in the peat swamp forests. This has contributed exposing peatland areas more, thereby allowing greenhouse gases to be released into the atmosphere. Therefore, to date, there have been extensive investigations how peatland fire can be prevented. In order to monitor and avoid fire out-breaking in peat swamp forests, in this paper we propose a LoRa based remote monitoring system. In our solution, we developed two Remote Sensing Clusters (RSCs), which are comprised of different sensor probes in order to collect remotely parameters that are crucial for understanding the condition of a peatland. This remote monitoring solution takes advantage of Cloud technologies in order to understand the pattern and holistic view of the situation in a peatland. This solution is the first of its kind deployed in peatland of Brunei Darussalam. Our findings are based on the data from the test-bed deployed in a peatland area indicate that the proposed solution can successfully obtain data with high reliability and accuracy.

## IOP Conference Series: Earth and Environmental Science

PAPER • OPEN ACCESS

## Opportunities in using visual IOT in the mitigation for peatland area

W S Suhaili<sup>1</sup>, Y Yusop<sup>1</sup> and A T Wan<sup>1</sup>

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[IOP Conference Series: Earth and Environmental Science, Volume 479, The 7th AUN/SEED-Net Regional Conference on Natural Disaster 25-26 November 2019, Kuala Lumpur, Malaysia](#)

Citation W S Suhaili *et al* 2020 *IOP Conf. Ser.: Earth Environ. Sci.* 479 012040

DOI 10.1088/1755-1315/479/1/012040



# POC using Camera to capture image using number line indicator: Experiment & Results from camera in terms binary image. Some Issues to ponder

## Requirements of Visual IOT

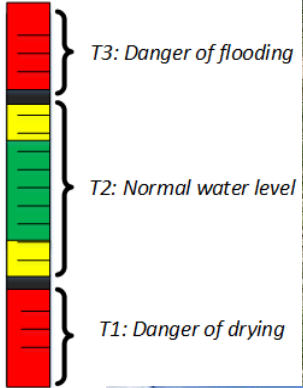
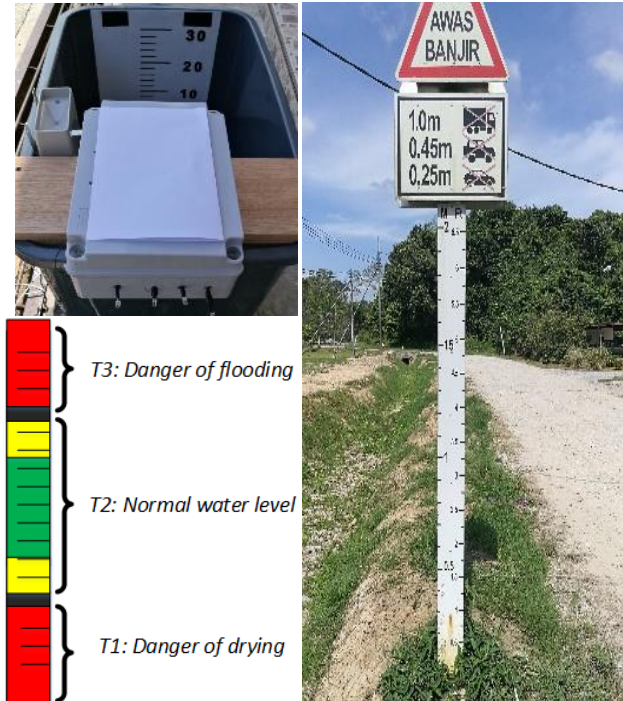
- Camera
- Data consumption
- Power consumption
- Connectivity
- Image processing

Capture image when required

Additional sensors to allow action triggered so image can be captured

## Issues with Visual IOT

- Need to consider <sup>1</sup>
- Advanced video transmission technology
- Information extraction from images by image recognition techniques
- Consideration for privacy issues are important
- Design Factors need to look at <sup>2</sup>
  - Low cost, High quality, Mobility, Security, Intelligence and Durable
- Disaster Mitigation <sup>3</sup>
  - Volcano monitoring, River monitoring, Land slide monitoring, Metropolitan Monitoring



Distance (meter)	3	5	10	15	20	25	30
Original images							
Thresh binary images							
Visibility of staff gauge	ACCEPTABLE					NOT ACCEPTABLE	
Visibility of line markers	ACCEPTABLE			NOT ACCEPTABLE			
Visibility of characters	ACCEPTABLE		NOT ACCEPTABLE				

Visual IOT: Architectural Challenges and Opportunities; towards a self-learning and energy neutral IoT. DOI:10.1109/MM.2016.96 (Ravi Iyer and Emre Ozer, 2016)

Design and Development of Real-time video transmission system using Visual IoT device. Proc. 12th Multidisciplinary International Conference on Artificial Intelligence (MIWAI 2018) K.T Murata et al, 2018)

Kei Murata and Team, from Visual Lab, NICT Japan



# Climate Change

## How do we mitigate the impacts of climate change and build resilient?

### Early Evidence of Climate Change



## Conclusion

- Visual IoT can be used to combat climate change and build resilient
- Good opportunity to adopt visual IOT in mitigating of peatland disaster
- React quickly to any incident – form early type of warning system
- Rooms for improvement and good research scope for the betterment of the mitigation system
- Other IOT sensor parameters are used to verify the water level and confirm image capture
- Triggered mechanism required for all system to be integrated as one

## Visual IoT concerns for any disaster monitoring deployment

- Storage requirements
- The kind of camera – night vision, infra-red, out door lenses
- Outdoor environment
- Placement of camera
- Image processing

Can be used in disaster management area.

- With real time notification and dashboard, end users are able to monitor remotely for both situation low and high
  - Low : Fire
  - High: Flood,

## Visual IoT concerns for Peatland area Deployment

- Distance depends on the kind of camera used
- Position of the staff gauge within or outside
  - To determine the threshold for the water level
- Tipping bucket – used to wake up camera
- Junction box
  - Ants repellent, ants nor rats
  - Heat generated – reflection paint
- Image transfer require 3G connection
- Solar panel for real deployment
- Triangulation of data
- Image processing