Project Title: Context-Aware Disaster Mitigation using Mobile Edge Computing and Wireless Mesh Network

Background :

Natural disasters occur frequently around the world. Internet of things (IoT) sensors can detect such cataclysmic events and initiate rescue actions. In existing IoT framework, data are transmitted to the remote cloud via wired connection for further analysis. Several issues remain to be addressed, including massive deployment effort, unavailability of vicinity communication infrastructure, data transfer over limited bandwidth, high latency in communication networks, and redundancy in disaster content.

Targets:

To develop a context-aware disaster mitigation system (CAMS) that utilizes mobile edge computing (MEC) and wireless mesh network powered by NerveNet.

Speaker: Ir. Dr. Tham Mau Luen @ Universiti Tunku Abdul Rahman, Malaysia

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Project Members :

Name	Institution	Name	Institution
Ir. Dr. Tham Mau Luen	UTAR, Malaysia	**Dr. Yasunori Owada**	NICT, Japan
Ir. Dr. Chang Yoong Choon	UTAR, Malaysia	**Dr. Goshi Sato**	NICT, Japan
Ts. Dr. Ezra Morris	UTAR, Malaysia	**Mr. Hachihei Kurematsu**	BHN Association/JTTA, Japan
Dr. Lee Ying Loong	UTAR, Malaysia	**Mr. Nobuyuki Asai**	Ready Affiliate Japan Co., Ltd, Japan
Mr. Lim Wei Sean	UTAR, Malaysia	**Prof. Myint Myint Sein**	UCSY, Myanmar
Mr. Teoh Han Wei	UTAR, Malaysia	**Prof. Thin Lai Lai Thein**	UCSY, Myanmar
Ir. Dr. Nordin Bin Ramli	MIMOS, Malaysia	**Prof. Zin May Aye**	UCSY, Myanmar
Dr. Tuan Ahmad Zahidi Tuan Abdul Rahman	MIMOS, Malaysia	**Ms. Emmon Maw**	UCSY, Myanmar
Mr. Sakda Sakorntanant	PIT, Thailand	**Dr. Suvit Poomrittigul**	PIT, Thailand

Project Duration : 1st April 2020 to 31st March 2022

Project Budget: $80,000

Project Activities: Group Meeting

Date	Description	Venue	Agenda
24 April 2020	Kickoff Meeting	WEB	• Project Overall Plan • CRDA • Explanation of Personal Data
8 May 2020	2nd project meeting	WEB	• Network architecture such as NerveNet LoRa, JGN Cloud Server and Web Server
12 May 2020	3rd project meeting	WEB	• NerveNet config and JGN
19 May 2020	4th project meeting	WEB	• CRDA Finalization
24 June 2020	5th project meeting	WEB	• Budget Plan • Equipment Procurement

Project Activities: Project Timeline

Party	Schedule	Task Description	Remark
UTAR/NICT/BHN	July - Dec 2020	• Define testbed and equipment • Study on NeverNet System • Explore use case of NerveNet	• Done • 80% • Pending for equipment
UTAR/MIMOS		• Define testbed and equipment • Study on disaster-aware video analytics • Train detection model	• Done • Done • 80%
UCSY/UTAR		• Define testbed and equipment • Study on evacuation route strategy	• Done • Pending for equipment
PIT/NICT		• Define testbed and equipment • Explore the use of JGN	• Done • Pending for equipment

Project Activities: Budget Plan

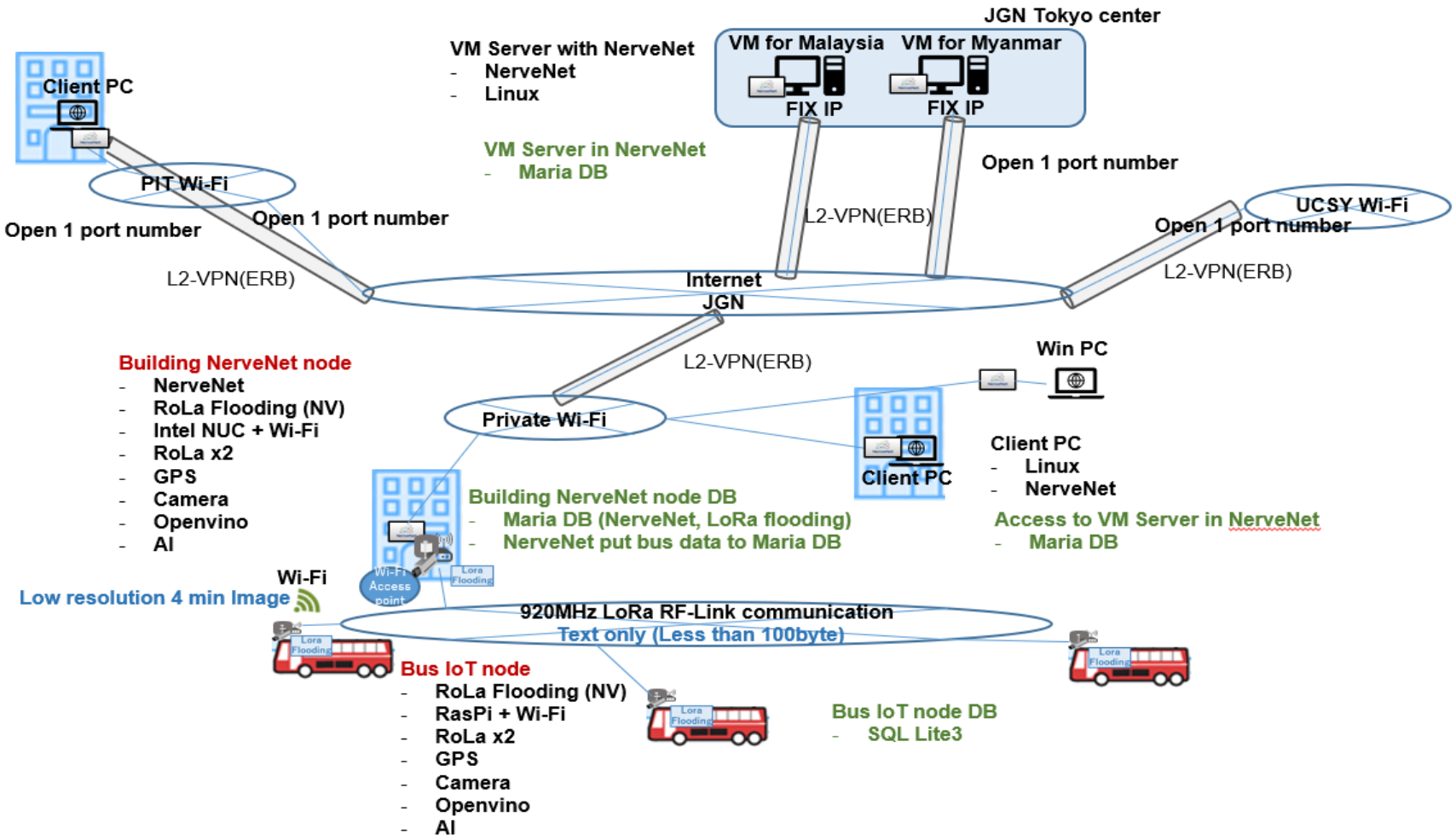
Title	Equipment	Amount	Remark
NICT 1st purchase	¥ 494,450	¥ 494,450	Approved
UTAR 1st purchase	• Bus IoT Node • Building NerveNet Node • NerveNet Gateway • Workstation	$28,051	Submitted to NICT for approval
PIT 1st purchase	Workstation for JGN	THB62,070	Remitted
UCSY 1st purchase	Workstation for JGN	$2,150	Approved

R&D Results: Defined Testbed

This project is divided into two parts:

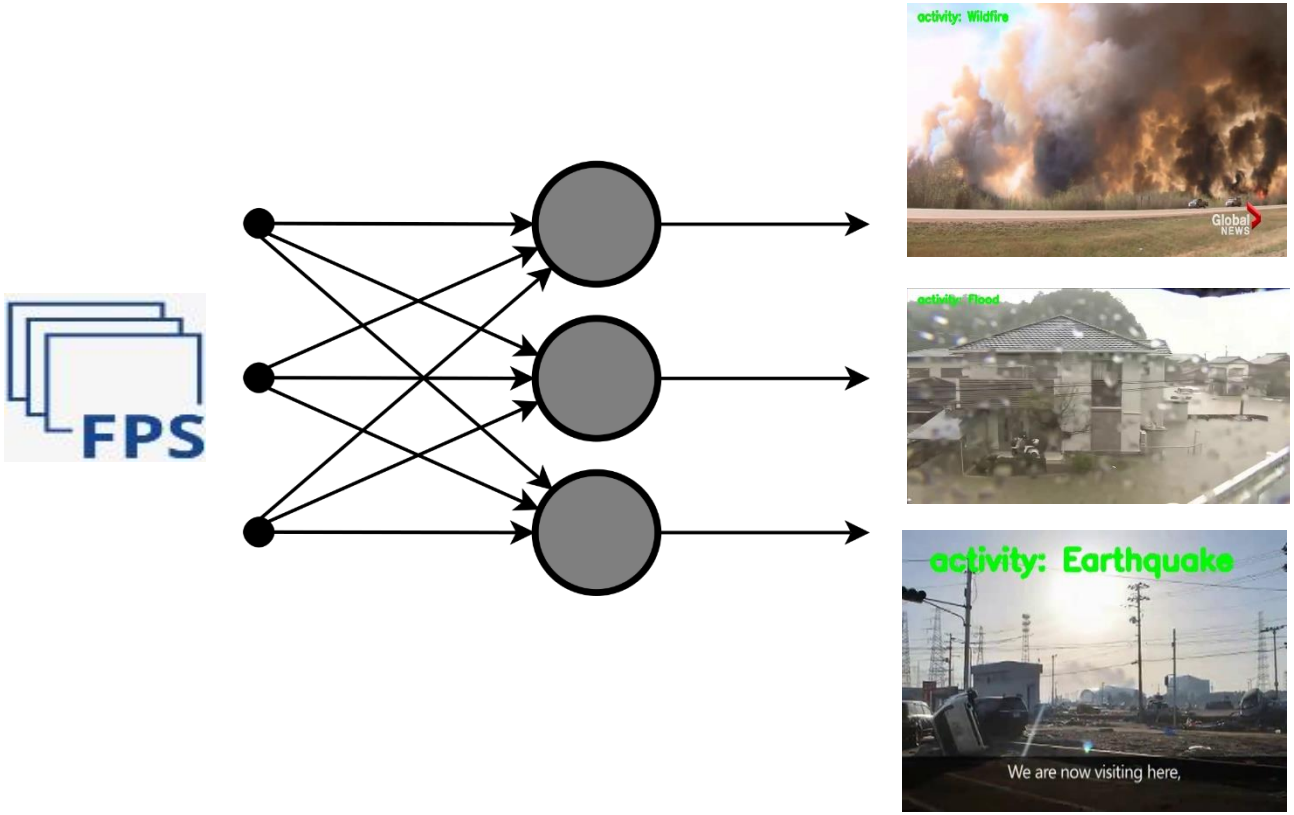
A. Disaster-Aware Mobile Edge Computing

B. Disaster Content Analysis and Visualization



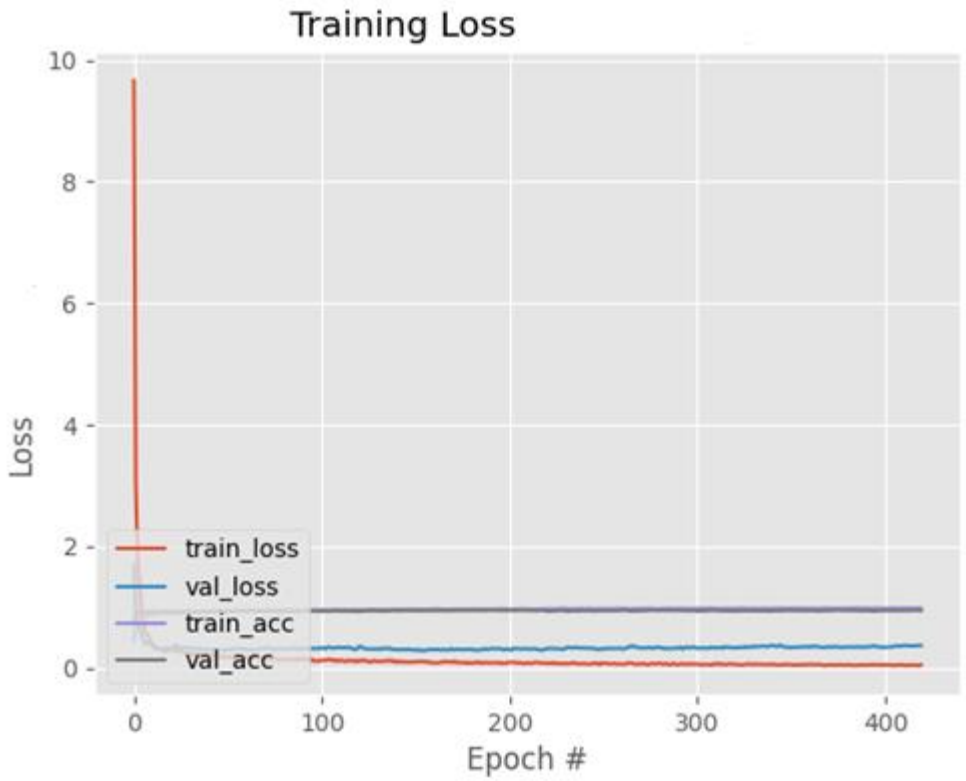
R&D Results: Disaster Detection

Generate a pre-trained model which detects three types of disasters:
(1) Wildfire, (2) Flood and (3) Earthquake



R&D Results: Disaster Detection

Specification	Parameter
Platform	Tensorflow
Tool	Keras
Neural Network	CNN
Device	CPU
Training Size	0.75
Testing Size	0.25
Validation Size	0.1
Batch Size	20
Step Size	8
Epoch	420
Min Learning Rate	1e-7
Max Learning Rate	1e-4



Societal Impact:

Disaster Recovery: In disaster scenarios, multiple affected areas may need the immediate help of emergency response unit. Based on the number of victims, activity of disasters and optimized evacuation routes, emergency response unit can dispatch manpower more efficiently, which could save more lives.

Network Scalability: NerveNet is a wireless capable node that can be a part of ad hoc network or mesh network that can be scaled for large coverage area or large number of devices easily by increasing number of nodes in mesh.

Monitoring Scalability: Mobile edge computing (MEC) enables camera to process the video and transmit only critical in formation to the cloud. NerveNet and MEC both complement each other to boost the disaster mitigation performance.

Collaboration: MEC is the core idea of 5G standard. Utilizing this concept in disaster mitigation aligns with the state-of-the-art technology. It encourages collaboration from academia, research institutes and industries from different ASEAN countries, based on a common MEC based IoT platform.

Conclusion:

- All meetings were held online due to pandemic situation.
- Project activities and scope of each party were outlined and discussed.
- More details on testbed implementation will be explored once equipments arrive.

Future works:

Party	Schedule	Task Description
UTAR/NICT/BHN	Jan - June 2021	• Setup of testbed for Wi-Fi/LoRa Nervenet • Configure NerveNet to support the new use case
UTAR/MIMOS		• Validate the real-time video detection • Integrate into edge computing platform
UCSY/UTAR		• Study on rapid route or optimal route identification on a complex road network for fire vehicle
PIT/NICT		• Setup of VM server with JGN