Republic of Indonesia

UNIVERSITY OF PALANGKA RAYA

Collaboration Program with the Private Sector for Disseminating Japanese Technologies for Forest Fire Monitoring and Management System in Republic of Indonesia Final Report

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Japan International Cooperation Agency (JICA)

NEC CORPORATION

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Map

Source: Sekai chizu http://www.sekaichizu.jp/

Figure 1. Palangka Raya district Central Kalimantan

Table of Abbreviations and Terms

Abbreviations and Terms	Official Name
BPBD	Badan Penanggulangan Bencana Daerah (Regional Disaster Management Agency)
GCF	Green Climate Fund
JICA	Japan International Cooperation Agency
LPWA	Low Power Wide Area
LTE	Long Term Evolution
ODA	Official Development Assistance

1. Background of the project

Forest fires in Indonesia are becoming more and more serious every year, and in 2015, economic damage (estimated by the World Bank) has reached US $ 16 billion (approximately 2% of GDP) in Indonesia. In addition, haze by forest fires has caused problems such as health damage of residents in neighboring countries and navigation problems of ships and aircraft.

In response to a large-scale forest fire that occurred in Indonesia, Dr. Ir. Siti Nurbaya M.Sc, Minister of Environment and Forestry, issued an emergency declaration and mobilized 25,000 troops and carried out firefighting operations. In addition, on October 8, 2015, President Joko Widodo requested emergency support such as firefighting operations to four countries including Japan for haze damage that spreads in the country.

In the current firefighting operations, information such as reports from residents and workers is mainly transmitted to firefighters using a transceiver, and then firefighters carry out firefighting operation. Some major plantations use GPS and drone to guide firefighters to the fire occurrence point, on the other hand, in most areas including national parks, transceivers are mainly used.

In such a situation, it takes much time for firefighters to reach the fire occurrence point because information from residents and workers is delayed. Therefore, fire damage is expanding due to the delay of the initial fire extinguishing.

Accordingly, a system that detects fires in real time and manages firefighting activities efficiently is essential in Indonesia.

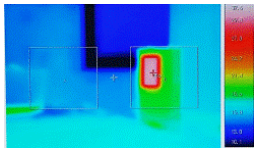
2. The technology projected to be spread in this project

This project provides a system integrated two technologies, “forest fire detection technology” and “firefighter’s activity management technology”.

<Forest fire detection technology>

The forest fire detection technology detects the fire by temperature measurement using an infrared camera, even when a person cannot find it with the naked eye, and automatically alerts when a hotspot exceeding the set temperature is detected.

Table 1. Forest fire detection technology

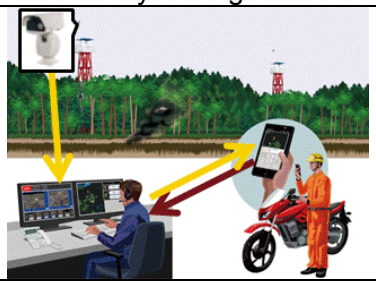
	Forest fire detection technology
Image of Product / Technology	 Infrared camera  Screen image of infrared camera
Features	・ Support hotspot detection function (automatically alerts when a hotspot exceeding the set temperature is detected.) ・ Detect fires even in smoke or at night ・ High precision temperature measurement ・ Calculate the location of the detected hotspot ・ Built-in visible light camera (the same area as the image captured by the infrared camera simultaneously) ・ Automatic monitoring of 24 hours 365 days

<Firefighter's activity management technology>

This technology realizes efficient firefighting activities by managing their activity status at the control center.

When the infrared camera detect the hotspot, the dispatch order including the latitude and longitude of the hotspot and the map information are sent to the firefighter's tablet.

Table 2. Firefighter's activity management technology

	Firefighter's activity management technology
Image of Product / Technology	
Features	・ Check the location of the firefighter and the fire occurrence point, then issue the dispatch order to the appropriate firefighter. ・ It is possible to reduce the on-site arrival time by sending the correct location of fire occurrence point to the firefighters. ・ The activity status is sent to the control center by a simple operation from the firefighter's tablet. ・ It is possible to grasp the activity status of the firefighters sent from the tablet at control center. ・ After the firefighting activities are finished, a report on the activity status of each firefighter is created automatically.

3. Purposes/Target of this project

In the current firefighting operations in Indonesia, information such as warnings from visual observation by firefighters and reports from residents and workers is mainly transmitted to firefighters using a transceiver, and then firefighters carry out firefighting operation. In such a situation, it much takes time for firefighters to reach the fire occurrence point because information from residents and workers is delayed and it is not possible to clearly identify the location of the fire. Therefore, fire damage is expanding due to the delay of the initial fire extinguishing.

Considering the introduction of this system is effective in solving this problem, the following items were evaluated on site.

- Detection ability of infrared camera
- Time to fire detection
- Arrival time to the site
- Efficiency of firefighting operations
- Feedback in the introduction of this system

In order to understand the effectiveness and usefulness of this system for relevant government agencies and private business operators in Indonesia, and to promote the sale of this system, fire-drills and workshop was held jointly with the University of Palangka Raya and BPBD.

4. Project Activities

<table>
<tr><th>Local Activities</th><th>Date</th><th>Activities</th><th>Purpose and Overview</th></tr>
<tr><td rowspan="3">No.1</td><td rowspan="3">Nov. 2017
(7 days)</td><td>Visiting to related organizations</td><td>Explain the outline of the project to Japanese government agencies in Indonesia and ask for cooperation and support.
In addition, explain the outline of the project to NEC Indonesia and ask for local business cooperation.</td></tr>
<tr><td>Kickoff meeting</td><td>Invite local stakeholders, explain the purpose of the project and the features of the system.
Then discuss actual activities including evaluation methods and ask for cooperation.
  
Kickoff meeting and group photo</td></tr>
<tr><td>Site survey</td><td>Conduct on-site surveys, consider customization items of the system, and confirm SOW (scope of work) for installation work and local procurement.</td></tr>
<tr><td rowspan="2">No.2</td><td rowspan="2">Jun. 2018
(4days)</td><td>Pre-installation</td><td>Implement preliminary work such as power supply, network and foundation of infrared camera.
  
Anti-theft fence and pole for infrared camera</td></tr>
<tr><td>Location survey for fire-drills</td><td>Conduct surveys of candidate sites for fire-drills. (demonstration by mock fire)</td></tr>
</table>

<table>
<tr><td rowspan="3">No.3</td><td rowspan="3">Sep. 2018
(12days)</td><td>Installation</td><td>Install the infrared camera and set up the software for the activity management system. Then conduct operation check for the infrared camera and the activity management system.
 
PC and Tablets of activity management system</td></tr>
<tr><td>Training</td><td>Explain to the members of the University of Palangka Raya and BPBD how to operate the system.</td></tr>
<tr><td>Location survey for fire-drills</td><td>Conduct surveys of candidate sites for fire-drills. (demonstration by mock fire)
 

View of candidate site for fire-drills
from the Infrared camera installation site</td></tr>
<tr><td>No.4</td><td>Dec.2018
(3days)</td><td>Preparation of fire-drills</td><td>Conduct rehearsals of fire-drills (demonstration by mock fire) with the University of Palangka Raya and BPBD.
 
Rehearsal of fire-drills</td></tr>
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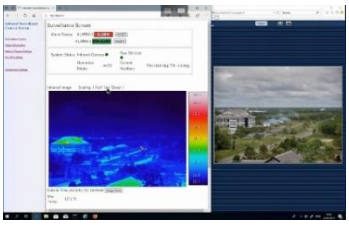
No.5	Jan.2019 (8days)	Fire-drills	Conduct fire-drills (demonstration by mock fire) to understand the effectiveness and usefulness of this system for relevant government agencies.   Activities of fire-drills   Screen image of this system during fire-drills
No.6	Mar. 2019 (4days)	Workshop	Invite relevant government agencies and private business operators in Indonesia to workshop with the University of Palangka Raya, then explain the result of fire-drills to understand the effectiveness and usefulness of this system. Receive comments and advice from relevant government agencies and private business operators in Indonesia to improve the sales strategy of the business.  Group photo of workshop
		Planning of business	Discuss and establish future sales scheme with NEC Indonesia.

5. Results/Achievements of the project

5.1 Detection ability of infrared camera

Table 3 shows the verification results of the performance evaluation of the infrared camera in local activities.

Table 3. Detection ability of infrared camera

<1 of 2>

	Verification 1	Verification 2	Verification 3
Purpose	Check the detection ability of the infrared camera	Check if the infrared camera can detect the hotspot in dead angle	Check the flame and its surroundings with an infrared camera
Object (Hotspot)	Flame(approximately 30cm high, approximately 15cm wide) / torch	Tray flame (1m x 1m tray, approximately 50cm high), 3m above the ground	Tray flame (1m x 1m tray, approximately 50cm high), placed flat on the ground
Distance	Around 660 m	Around 1.5km	Around 100 m
Result	The infrared camera was able to detect the flames of both 1(one) and 2(two) torches.	The infrared camera was not able to detect above object.	The infrared camera was able to see the flame and its surroundings clearly. The infrared camera was able to see them more clearly than visible light camera.
Remarks	In the case of 1(one) torch, it was able to detect slightly but in the case of 2(two) torches, it was able to detect clearly. Therefore it was confirmed that a hot spot of approximately 30cm x 30cm was able to detect at a distance of around 660m.	It was confirmed that the infrared camera was not able to detect the heat around the flame. Therefore the flame and its surroundings with an infrared camera was going to check in Verification 3.	
Photo of Object			

	Verification 4	Verification 5
Purpose	Check if the infrared camera can detect the hotspot at the fire-drills candidate site on the ground	Check if the infrared camera can detect the hotspot at the fire-drills candidate site above the ground
Object (Hotspot)	Tray flame (1m x 1m tray, approximately 50cm high), placed flat on the ground	Tray flame (1m x 1m tray, approximately 50cm high), 1.5m above the ground
Distance	Around 660 m	Around 660 m
Result	The infrared camera was not able to detect above object.	The infrared camera was able to detect above object clearly. On the other hand, the visible light camera was not able to see above object.
Remarks	The infrared camera was not able to detect above object because the tall grass was in front of the object. Therefore, verification 5 was checked if the infrared camera can detect the hotspot 1.5m above the ground on the same point.	
Photo of Object		

According to above verifications, the following results were obtained.

- If there was an obstacle such as plants between the hot spot and the infrared camera, it was not able to detect.
- The hot spot of approximately 30cm x 30cm was able to detect at a distance of around 660m.
- The infrared camera was able to detect the heat around the flame as well as the hot spot.
- Even if the hot spot was not able to see visually by the visible light camera, it was able to detect by the infrared camera.
- Even if the visibility was bad due to smoke, it was able to detect by the infrared camera

5.2 Shortened time from fire occurrence to site arrival when using this system

(1) Shortening time from fire occurrence to fire detection

The current fire detection by visual monitoring is not able to find a small fire. On the other hand, the infrared camera can find a small mock fire that cannot be detected visually. Therefore, the detection time can be significantly shortened by using an infrared camera.

(2) Shortening time from fire detection to dispatch order

In current firefighting activities, it takes about 10 minutes for fire detection, notification, identification of fire occurrence point and dispatch order. In this system, the fire detection and the dispatch order are performed almost simultaneously, so it is possible to significantly reduce that time.

(3) Shortening time from dispatch order to arrival on site

This system calculates the latitude and longitude information of the fire occurrence point and displays it on the map, so it is possible to arrive at the site without getting lost.

On the other hand, in the current operation, it takes much time for firefighters to reach the fire occurrence point because the location of the fire occurrence point is not clear and the communication with firefighters are used by mobile phone or transceiver. Therefore, it is possible to significantly reduce the time to arrival on site.

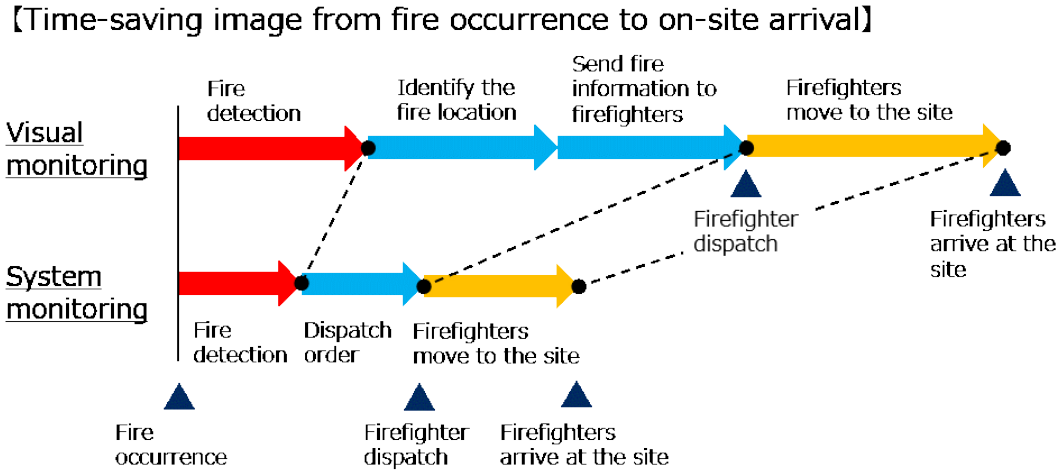


Figure 2. Time-saving image

5.3 Achievements of the project

- From the comments in the fire-drills and workshop, it has been confirmed that detection of forest fires by visual observation, which is currently used, is difficult.
- It was confirmed that the communication with firefighters are used by mobile phone or transceiver, the location of the fire occurrence cannot be identified clearly, and the instruction is not clear so that it is difficult to reach the fire occurrence point timely and quickly.
- It was confirmed that this system can reduce the time from detection of forest fires to on-site arrival through fire-drills.

- It was confirmed that it is difficult to detect a peat fire with an infrared camera due to dead angle caused by trees.
- Relevant government agencies and private operators in Indonesia were able to recognize the effectiveness and usefulness of this system against forest fire through fire-drills and workshops. And it was confirmed that there was a high demand for the introduction of this system.
- The results of this project were explained to NEC Indonesia and the scheme that enables NEC Indonesia to sell independently was established.
- We will continue to share information with person in charge of GCF in JICA to develop the GCF project.

6. Business Possibility at the current step

Private companies for tree planting and palm plantations have great potential to introduce forest fire systems. On the other hand, government agencies need to budget and it is difficult to introduce the system immediately.

7. Reasons of judging the Business Possibility

Government agencies have difficulty making their own budgets, so they need to use other funds to make projects. As the private sector alone cannot introduce this system to government agencies immediately, it is necessary to establish a relationship between the Japanese government and relevant organizations in Indonesia to obtain a budget.

Since communication with the Ministry of Environment and Forestry responsible for forest fires is difficult, close cooperation with donors including JICA is required.

8. Remaining issues for business development and countermeasures

(1) Development of projects utilizing funds

In order to introduce this system in Indonesia, it is necessary to propose appropriate funds to the Indonesian government. Therefore, through this project, the possibility of development of projects utilizing GCF were considered. As a result, it turned out that JICA is working on forest fire measures as Technical Cooperation Projects in Indonesia. So we decided to share information with JICA and work on project development.

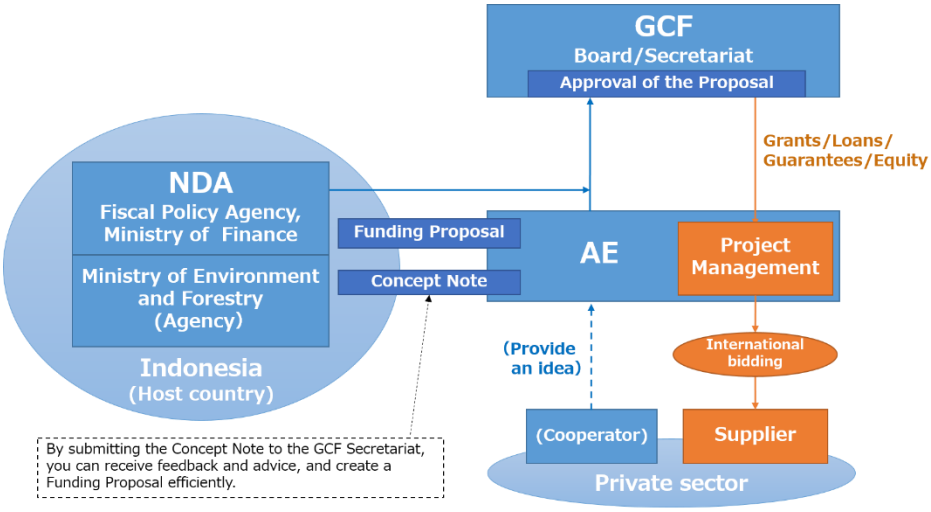


Figure 3. Process to start GCF project in Indonesia

(2) Promotion of sales to private companies

NEC Indonesia is taking the lead in promoting the introduction of this system to private companies. It is important to understand the needs of each customer properly and to propose a system according to their needs. We promote sales activities in collaboration with NEC Indonesia.

(3) Measures when public networks cannot be used

There are many places where public networks cannot be used in planted areas. For the time being, we will promote the introduction of the system in the towns and fields where public networks can be used and in forests close to the area where residents live. And in the future, we will examine the possibility of networks using LPWA and LTE in place where public networks are not available.

(4) Measures when there are dead angles

With only one infrared camera, there may be dead angles due to shadows or geographical factors. Therefore, we propose to use multiple infrared cameras to reduce dead angles.

(5) Measures taking into account differences in organizations of firefighting by region

As firefighting activity may be different depending on each region, we make appropriate proposals in consideration of the local situation.

(6) Application to peat fire

Since peat fires are covered with forests and are dead angles, it is difficult to detect them with an infrared camera installed in the tower. Therefore, we propose a handy-type infrared camera that can be carried by fire-fighters and detect peat fires on site instead of this system.

9. Plans for future business development

Table 4. Business plan

	Tasks	Period	Action items	Remarks
1	Improvement of this system	Timely	・Identify customer needs and respond individually	・Improvement of customer satisfaction
2	Sales activities for private companies	2019/04～	・NEC Indonesia will sell this system initiatively. ・Promote sales to private companies participating in the workshop.	
3	Full-scale business development	2019/10～	・Both NEC and Sumitomo Forestry will sell the system.	・First of all, Expand business to private companies. ・For relevant government agencies, we will work on a detailed study of developing projects utilizing funds.
4	Possibility of business collaboration with different industries	Timely	・Consider the possibility of business collaboration with security companies in Indonesia and fire extinguisher manufacturers	・Expansion of sales channels (e.g. Security companies use our system to propose forest fire management services.)
5	Remote Sensing Service	After 2020	・Fire detection by satellites	・Try monitoring at places where an infrared camera cannot be installed
6	PR activities	Timely	・Posting on NEC's external reports (e.g. Integrated reports, sustainability reports, environmental reports)	

10. Possibility of collaborating with ODA projects

In the workshop, the introduction of this system was strongly requested by BPBD, who is actually in charge of firefighting activities.

However, the forest fire budgets of central government and local governments in Indonesia are not sufficient, and it is difficult for private companies alone to overcome this situation.

In consideration of such situation, as technical and financial support from Japan is required, so it is necessary to collaborate with the ODA Project.