Building Disaster Resilient Community by ICT and Youth Empowerment in Indonesia from the survey of the Mt. Merapi – Introduce New Idea of Wide view Disaster Information Predict System

Toshiya Tsukamoto*
Osaka University*

***ABSTRACT*:** Osaka University and Universitas Gadjah Mada (UGM) have been corroborated to set up the Satellite office in UGM, Institute of International Studies (IIS). We have developed the application for the multi-cultural and multilingual situation to get the Disaster information system. This is The Multilingual-Wide view Disaster Information Predict System (We call it "CARED"). We are planning to have a test of this system for Indonesian Consulate in Osaka as a Disaster Information System for Indonesian people who live in Japan, also. This idea made by my experiences in Sri Lanka Conflict 2009 that my methodology of how to reorganize the peace zone in the field. I call it Zone of Peace index (ZPI). It methodology show use the scale of the people's mind about the happiness and peace.

In 2014, Osaka University –UGM Satellite office supported three group of student community services (KKN) taking location in three villages in Yogyakarta. All three villages have different characters to each other in correlation to its hazards. Also as requested from the residents of the villages, more varieties of programs were conducted in addition to the infrastructure programs such as evacuation map for the life-stock, food management and security during disaster, alternative food-stock and cleanliness in shelter. We have analyzed the to use ZPI methodology. This report will summarize the research and how did I have developed the CARED App for the disaster victims. In the end 2014 term, the office is successfully sign a MoU with Badan Penanggulangan Bencana Daerah (BPBD) Yogyakarta. This legal and formal cooperation will open the more chances for Cared to be institutionalized in government agency for disaster management. We need to consider and trust that improvement in social risk management consciousness will be raised from improvement and empowerment in college students' consciousness in the future.

KEYWORDS: Zone of Peace Index (ZPI), multicultural Disaster Management, wide view disaster information system, Disaster Resilient Community, human centered disaster management

1. Problems found in research on disaster countermeasures

The Yogyakarta Special Region (with a population of approximately 4 million) has lost many residents to natural disasters including the Java Earthquake in 2006 and the eruption of Mount Merapi volcano in 2010. This March we started research on the status of the disaster countermeasures in place there to identify the particular problems that they face. In July and August, we dispatched 29 undergraduate students of Universitas Gadjah Mada (UGM) to two Sub-Districts, where they spoke with the residents of local villages and helped them draw hazard maps, draft disaster countermeasures, organize evacuation drills and create websites for the villages. Although the region's local government has encouraged villages to draw hazard maps since 2009, most of the villages have not yet prepared any.

The results of the research above revealed that there

were problems in their method of collecting information at the time of disaster. The national government and the Red Cross understand that the system for collecting information at the time of disaster is not sufficient and they are therefore exploring an effective information collection system in the case of disasters, though no appropriate system has been developed yet.

In disaster prevention, local municipalities are mostly in charge of implementing appropriate measures. In an actual disaster, information gathering is performed at the discretion of local municipalities. In Japan, under the country's vertically divided administrative structure, it is no exaggeration to say that disaster prevention and disaster relief measures are entirely placed in the hands of the nearly 1,800 local municipalities nationwide. A similar situation was observed in Indonesia in the research conducted by the RESPECT Satellite Office in the first half of this year. All actions are taken in a vertically divided structure, in which almost none of the municipalities have a system linked to neighboring municipalities to cooperate in response to a disaster. It is necessary to establish a horizontal network among local municipalities, and also to integrate the disaster prevention measures at the municipal and provincial (regional) levels. Our research found that Indonesia has the same problems as Japan.

In recent years in Japan, we have seen many large-scale disasters, such as torrential rain, tornados occurring in unexpected areas, and typhoons causing extraordinary damage. Earthquakes have also caused damage to broad areas, which often exceeds the handling capacity of local municipalities. This is why many volunteers played a crucial role in the aftermath of the Great Kanto Earthquake, the Great Hanshin-Awaji Earthquake and the Great East Japan Earthquake. As public awareness of such volunteers has improved, we see many people willing to make some kind of a contribution at the time of a disaster. Thus, besides physical volunteer activities, we examined the possibility of obtaining support from many residents for information gathering in addition to efforts by local municipalities.

Yogyakarta is located in the central part of Java, where most residents speak both Indonesian and Javanese. For such a multicultural region, it is necessary to analyze the differences between various cultures before determining earthquake countermeasures.

In Japan, municipal actions are mostly taken using the Japanese language and support for foreign residents from various areas is not sufficient, Bringing immeasurable anxiety and stress to those who experience a disaster in a place where they do not understand the language. Some municipalities prepare disaster prevention manuals in several languages, but it is doubtful that foreigners are able to fully understand Japanese disaster prevention measures by reading such translated manuals. It is probably necessary to prepare manuals based on sufficient understanding of the cultures and customs of each foreign country.

We examined the situations for various types of disasters, and found that residents have a poor understanding of countermeasures for not only earthquakes and other natural disasters but also infectious diseases. If a new influenza (H5N1), for example, develops into a pandemic, the basic response in Japan is to stay home. Data from some 5,000 medical centers all over the country is not available. I therefore believe that, instead of waiting for data from the central government, each municipality should have a certain ability to collect and analyze data of infectious diseases.

Since the situation is found to be almost the same in the Yogyakarta Special Region, a system to gather and analyze as much local information as possible is

necessary to plan their disaster relief measures.

2. Need for broad-area disaster relief measures

As represented by the recent Great East Japan Earthquake and the Sumatra earthquake ten years ago, most earthquakes did not occur within the small area of a single municipality but caused damage to a broad area of over 500 km. If the currently anticipated series of earthquakes occur from the Nankai Trough to the Tonankai and Tokai areas, linked to the Tokyo metropolitan area, local municipalities, in taking countermeasures, must have a broad-area network between at least the prefectural government and the municipalities. It is questionable, however, whether appropriate actions can be taken in the present vertically divided administrative structure in Japan.

As mentioned above, other projected disasters, such as a pandemic of new influenza and an eruption of Mt. Fuji, may cause damage to a broad area of the entire Kanto region and Tokai area, depending on the wind direction. Moreover, the pandemic is highly likely to spread throughout Japan, then to Asia and even all over the world. Earthquakes, tsunami, volcanic eruptions, and infectious viruses are not confined to national boundaries nor municipal barriers.

From this perspective, similarly in Indonesia, for future disaster relief activities, it seems necessary to establish a system that enables the gathering information from a broad area and finding ways to make effective use of the collected information for the benefit of residents of the disaster-affected area.

3. Zone of Peace

3.1. Background

Mt. Merapi (Indonesian: Gunung Merapi) is a volcano located in Central Java, Indonesia. The Volcano has been very active since May 2006. On May 13 of that year an official evacuation alert was issued and on the 15th an extensive pyroclastic flow occurred. In 2006 earthquakes occurred in Java, and the region of Yogyakarta was visited by a variety of disasters in the form of quakes, tsunamis, and volcanic eruptions.

A a result of massive volcanic eruptions in October and November of 2010, more than 350 people died and over 300,000 were forced to evacuate their homes. The nearby Borobudur temple complex ruins, a World Heritage site, was covered in ash, leading to a sharp drop in tourist visitors, which usually number about 2 million annually.

For approximately two years after these volcanic eruptions of 2010, together with university students from Japan and from the University of Gadjah Mada (in Yogyakarta), I visited villages in the Yellow Zone and Red Zone to conduct a survey of disaster prevention awareness.

3.2. Survey areas

Our first visit was to the village of Pangukreejo in the Red Zone. Its population was 676 and 195 of its houses were destroyed by the volcanic eruption. It is located 10 km from the mouth of Mt. Merapi. According to local government officials, many of the village's residents lost their homes as a result of the pyroclastic flow, but many in the village remained in the locality. They did not wish to move away because they are taking up work opportunities such as selling souvenirs and photos of Mt. Merapi to the tourists who came from all over Indonesia to see the state of the mountain, and arranging tours of the affected local areas by car.] Since staying within this Red Zone was not permitted, relief supplies were not distributed here. However, it seemed that a good number of people worked energetically at re-establishing a livelihood by setting up shops or catering to the tourist trade.

Next, we visited the village of Pentingsatri in the Yellow Zone. Its population was 398. Almost none of the houses in the village suffered damage. The

village is located 12.5 km from the mouth of Merapi. Before the eruption many of the village residents earned their livelihoods through eco tours and the like, and they continued to do this. In addition, relief supplies from the government and other organizations were distributed in the village.

3.3. Survey method

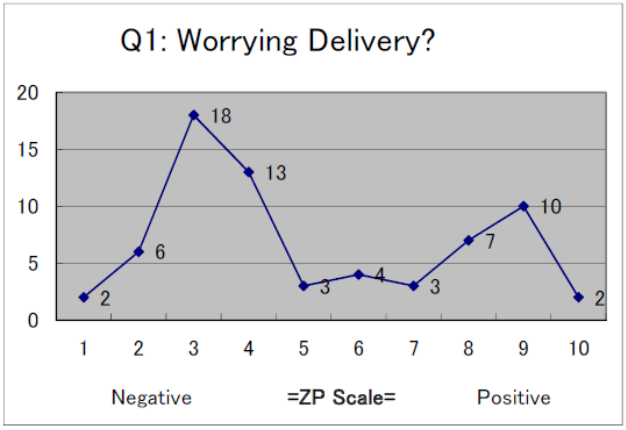
The survey was conducted by pairs of Japanese and Indonesian students posing a set of 16 questions randomly to villagers in each of the locations. The survey results were then used to compute a Zone of Peace Index (ZPI) based on qualitative questions relating to disaster prevention, to quantitatively assess the safety situation of residents. (Tsukamoto Method)

In what ways can people achieve peaceful living conditions? The absence of war alone does not result in peace. For example, Japan has enjoyed more than 60 continuous years without a war, yet the lack of social security that has accompanied economic development has led to social chaos.

Certainly it cannot be said that the mere absence of war has brought peace. Genuine peace enhances the peace of mind or sense of security of citizens because it enables the security of communities, by facilitating a stable livelihood, education, and health care, and ensuring public law and order. It has been a challenge to quantify this kind of qualitative data. However by simply assigning scores out of 10 to each of a series of qualitative questions, it is possible to draw out useful analytical findings—something that is not possible with two-choice questions.

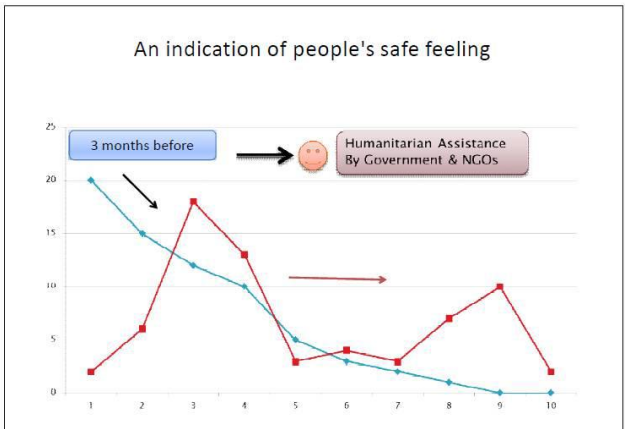
The graph below was constructed by applying the ZPI method to a survey of the attitudes to childbirth of pregnant women in an IDP (internally displaced person) camp after the conclusion of a conflict.

3.4 Sample of survey in Sri Lanka at 2007



Graph 1: Attitude survey of pregnant women on childbirth (Sri Lanka)

If the question posed in the IDP camp were “Are you worried about given birth?” “Yes” or “no,” the results would reveal that many worried people, but with the ZPI method, as shown in the graph above, there is substantial variation in the feelings of these people. And we can imagine from this graph that this sense of anxiety moves over time like a wave, according to conditions, as people’s feelings change. Given their situation, people in the camp were questioned to find out if they were worried about giving birth?” If they were asked only for a “yes” or “no” answer, the results would reveal a high number of responses indicating that they were worried. However, with the ZPI method (see graph above), we can infer that the feelings of the worried people are temporary. We could also infer that that this sense of anxiety, as mapped on the graph, would move like a wave according to situation and conditions.



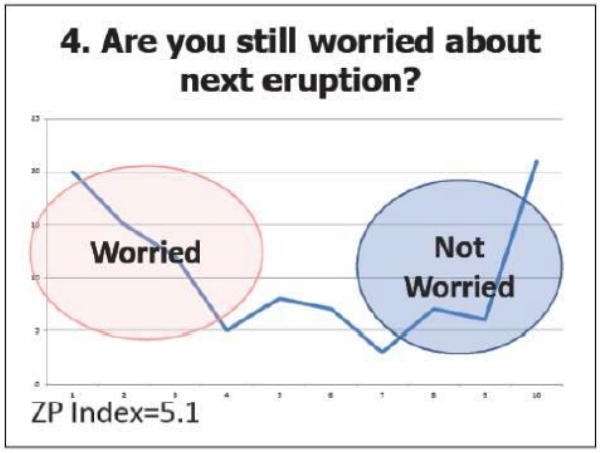
Graph 2: Image of the data of 3 month before (Sri Lanka)

The survey was taken in the third month after the people moved to the IDP camp. We could assume that three months earlier, having found themselves in miserable circumstances, many of the IDPs would have felt anxiety about how they would be able to deliver a child. If the same question were asked at that time, we would most likely see a much larger peak on the left side of the graph.

Then over the following three months, as government health agencies and NGOs distributed dietary supplements and dispatched health workers, midwives, and doctors, the IDPs would have come to learn that there was a sufficient system in place to support the delivery of a child. As a result the peak of "anxiety" would have subsided and a new "no anxiety" peak would have appeared on the graph. In addition, this ZPI method analysis indicates that there is a need to examine ways to develop a system to make the "no anxiety" peak larger by providing further, continuous support.

The ZPI value here is 5, representing an intermediate value for the sense of security felt in the IDP camp.

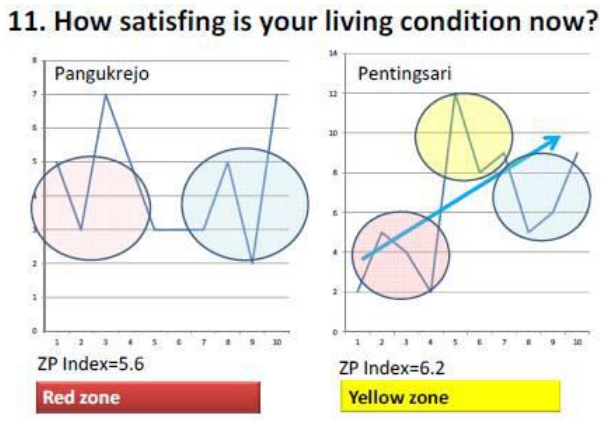
3.5. An Attitude Survey of Evacuation Zones after Eruption of Mt. Merapi in Yogyakarta, Indonesia



Graph 3 Are you still worried about the next eruption?

The responses of the people in the Yellow Zone and Red Zone to this question tended to be similar.

That is, in broad terms there seemed to be two basic kinds of people. One group of people was worried; the other group was unworried. It's only natural that the people in the worried group were sincerely worried, since many people had died as a result of the pyroclastic flows and many were forced to evacuate—not to mention that there were people still living in the Red Zone despite the fact that the government had prohibited this. Yet, many people remained "unworried," while a few others were undecided.. Many Indonesians are devoted Muslims and tend to leave their fate to God, so there were many people who were "unworried" for this reason.



Graph 3: sample of the ZPI data about "the satisfying the living condition?"(Merapi)

This question assesses the feelings of villagers about their present living conditions. The graphs for the residents of the Red Zone and Yellow Zone show completely opposite patterns. The people of the Red Zone are divided into two main groups—those satisfied with conditions and those dissatisfied. Only a small number of people are in the intermediate class. Not surprisingly, there are quite a few factors that give rise to dissatisfaction, due to the fact that the Red Zone receives no external support. In contrast, there are also many positive villagers who are satisfied because they are able to work catering to tourists in areas they are very familiar with.

On other hand, the people of the Yellow Zone can be broadly divided into three groups—a dissatisfied group, an intermediate group, and a satisfied group. Although the Yellow Zone receives support, the local farm production has been impacted by ash and other effects, making it difficult for some villagers to sustain a livelihood. Some villagers were earning a livelihood by conducting eco tours even before the disaster. So we can conclude from this graph that providing technical support to the intermediate group would shift them into the satisfied group. The ZIP value, which is now 6.2, could perhaps be increased to over 7.0 by implementing greater direct support to the dissatisfied villagers and technical support to the intermediate group, thereby leading to a greater numbers of satisfied villagers.

This question assesses the feelings of villagers about their present living conditions. The graphs for the residents of the Red Zone and Yellow Zone show completely opposite patterns. The people of the Red Zone are divided into two main groups—those satisfied with conditions and those dissatisfied. Only a small number of people are in the intermediate class. Not surprisingly, there are quite a few factors that give rise to dissatisfaction, due to the fact that the Red Zone receives no external support. In contrast, there are also many positive villagers who are satisfied because they are able to work catering to tourists in areas they are very familiar with.

On other hand, the people of the Yellow Zone can be broadly divided into three groups—a dissatisfied group, an intermediate group, and a satisfied group. Although the Yellow Zone receives support, the local farm production has been impacted by ash and other effects, making it difficult for some villagers to sustain a livelihood. Some villagers were earning a livelihood by conducting eco tours even before the disaster. So we can conclude from this graph that providing technical support to the intermediate group would shift them into the satisfied group. The ZIP value, which is now 6.2, could perhaps be increased to over 7.0 by implementing greater direct support to the dissatisfied villagers and technical support to the intermediate group, thereby leading to a greater numbers of satisfied villagers.

4. Features of the Wide View Disaster Information System from ZPI survey

According my experiences of the field researches by ZPI, I realized that how can I show the result of the Disaster condition and the people’s feeling at the disaster time.

Unlike the municipal government-controlled systems being developed by municipal governments, this Wide View Disaster Information System is an information system operated under the initiative of residents. In this system, residents are requested to answer by cellphones some simple questions prepared in advance regarding the situation after various disasters, based on which the status of the disaster-hit area is described in maps colored in red, yellow or green, depending on the degree of damage and the progress of support. These maps are provided to local municipalities, the Red Cross,

NGOs, etc. as useful information for implementing disaster countermeasures. This system was developed based on the concept proposed by Osaka University, through several discussions with the provincial government's disaster management agency, Red Cross, etc. This system includes the following features:

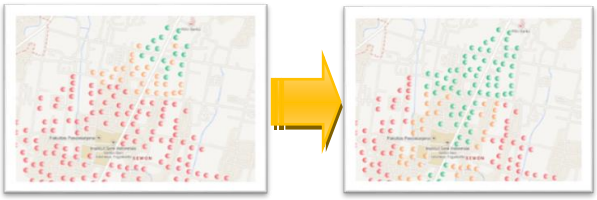
4.1. The degree of damage is visually presented on Google Maps, enabling easy identification of the areas that need emergency relief. An overall picture of the damage can be grasped from the wide-view data while local information on each municipality can be analyzed by enlarging the map. For collaborating municipalities, the system allows access to the guarded private information of the disaster-hit area. For the general public, it offers wide-area maps of the damage status.

Table 1 Sample Map of CARED

Map1: Sample of wide view Disaster Result

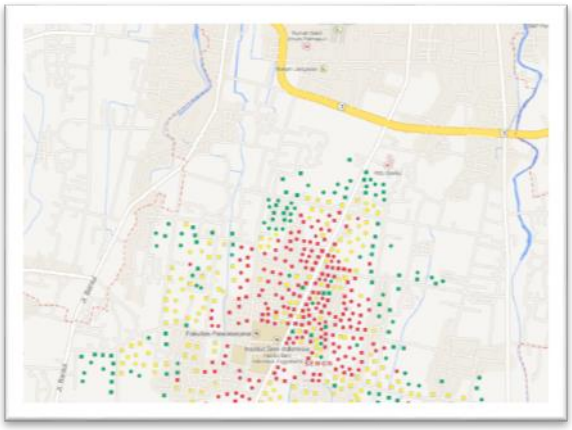
4.2. After the disaster, it collects information every week and shows the progress of relief activities by changing color.

Table 2: Changing Progress disaster situation



Map2: Sample of the progress of Food distribution.

4.3. By enlarging the distribution map on Google Maps, the detailed status of the damage of each area can be viewed.

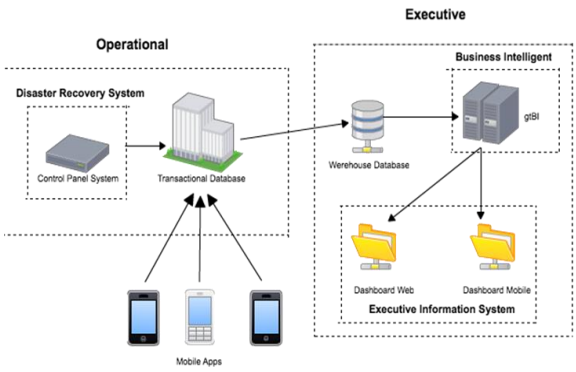


Map3: Image of the spot map of Disaster

4.4. Information from a wide area can be collected, statistically analyzed, and plotted on graphs for the wide area or each municipality.

Graph4: Automatically Statistic data analysis

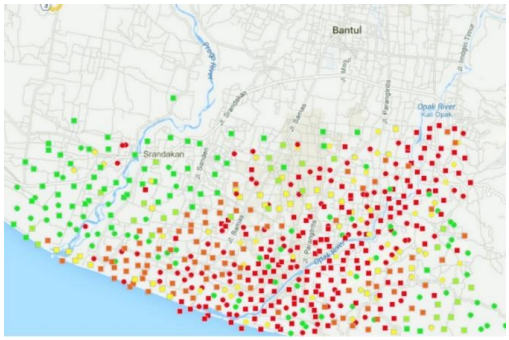
4.5. So far, it has been difficult to statistically collect qualitative information regarding relief activities such as complaints from the victims, which are often heard at disaster sites during relief activities. On the other hand, there are many victims who are physically or mentally unable to express themselves. This system enables residents to communicate their conditions or feelings via cellphone. It helps make the silent voices in a disaster-hit area heard.



4.6. This system allows each local municipality to release trends in the population infected by highly virulent new influenza. If the new flu is highly virulent, people are basically required to stay home while the telephone lines for public health centers etc. are likely to be in a highly confused state. In the case of an infectious disease, volunteers are not able to freely move around like in the case of an earthquake. Under such a situation, there is no doubt that a disaster information system using cellphones will work effectively. Moreover, by identifying the infected areas, users are able to decide the locations to distribute Tamiflu or relief supplies. As shown by the graph below, highly virulent flu requires a long-term support system, though at present, Japanese municipalities have no way to grasp the infection status. The Wide View Disaster Information System will enable each municipality to analyze the situation and plan relief activities

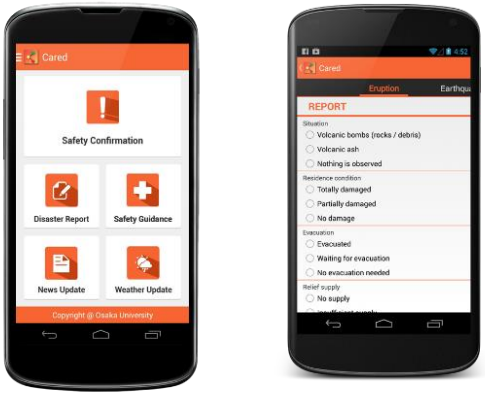
5. What is CARED? [i]

CARED is a mobile app for a **Multilingual Wide View Disaster Information Prediction System**.



Map 3: Sample of Wide view Disaster Information

Based on affected people's response to simple questions in an app on their cell phones, disaster damage is visually displayed on a map. The damage levels are plotted according to severity as red (most), yellow, or green (least) dots on a map. To predict damage and assist in emergency aid planning, the information can also be organized into data sorted by municipality. CARED was developed by Osaka University led by Professor Tsukamoto and piloted in the Yogyakarta Special Region in partnership with the Department of International Relations, Universitas Gadjah Mada. The system is currently available 8 languages like in Indonesian, Javanese, and English. Japanese, Spanish, Portuguese, Korean, and Chinese versions 2015. We wish to use this system more than 20 languages in the near future.



6. Basic features of CARED

(1) **Visualization of disaster analysis:** Information is displayed in map or data form based on responses from affected people's smart phones.

(2) **Collection of disaster information from a wide area:** Data is collected from multiple municipalities, allowing wide-range disaster management and support measures to be designed.

(3) **Assessment of the progress of support activities:** Weekly follow-ups analyze the changes in affected people's situations.

(4) **Nationality-based analysis:** As part of their disaster management measures for foreign residents in Japan, embassies and consulates can help identify foreigners affected by a disaster.

(5) **Disaster guidelines for foreign tourists in Japan:** General guidelines for each type of disaster are currently available in nine languages (Indonesian, Javanese, English, Japanese, Korean, Chinese, French, German, and Thai). Additional languages (Spanish, Portuguese, Italian, Russian, Tagalog, Vietnamese, Burmese, Hindi, and Nepalese) are currently under consideration. This information can be used as part of the disaster readiness measures for foreigners during the 2020 Tokyo Olympic Games.

(6) **Prediction and Tracking of Communicable Diseases:** Disease outbreaks (e.g., influenza) are followed by municipality, allowing each municipality to take appropriate measures according to its own estimated contamination peaks.

(7) **Monitoring of other types of disasters:** This tool is applicable to other types of crises such as outbreaks of livestock diseases (e.g., hoot-and-mouth disease) and weather-related issues (e.g., snowfall).

(8) **Incorporation of a personal safety confirmation tool:** In addition to visualizing the overall picture by color (red ○ for unsafe, green ○ for safe) on a map, individual data can be sent to up three designated emails or SMS numbers.

(9) **Mapping of domestic and foreign trekkers:** In case of an emergency, the location and movements of trekkers on Mt. Fuji and other volcanic mountains can be visually identified.

(10) **Tracking of impending disasters:** Residents living in 1 of the 52 high-risk landslide areas nationwide can report signs of an imminent threat (e.g., spring water running or rumbling noises coming out of a mountain).

7. Potential applications of CARED (future development)

(1) **A safety confirmation tool for schools, organizations, and companies:** Just like the basic system, this application retrieves information on the safety and conditions of students and school staff during a disaster and displays it using a color-coded map. This along with basic regional information should help identify the number of students and staff in heavily damaged areas and aid in planning appropriate actions. Conversely, schools, organizations, and companies can protect and manage personal data on their own, enabling communication with individual members at their actual locations if Skype or SNS contacts are registered with their emergency contacts. Additionally, this system can be used as a safety confirmation tool for international students by partnering with supporting companies.

(2) **A safety confirmation tool for Japanese citizens abroad:** This system can be introduced as a Japanese technology that can be used globally to estimate the damage from a disaster in different parts of the world. Using the system in the same manner as described above allows safety information of Japanese nationals and tourists in foreign countries in a disaster area anywhere in the world to be analyzed.

(3) **A disaster information system for foreign residents or tourists in Japan:** Similar to above, this system can be utilized to estimate the impact on foreign residents or tourists when a disaster occurs in Japan.

(4) **A tool to monitor outbreaks of highly virulent illnesses:** In principle, patients who have contracted highly virulent new strains of influenza like H5N1 or other highly communicable diseases are expected to self-quarantine at home. During influenza season or during an outbreak of another disease if necessary, the system maps patients with temperatures over 38 °C in red, around 37 in yellow, and 36 or below in green.

The rates are analyzed by municipalities every week to estimate the disease rates, allowing municipalities or public health centers to comprehend the fever situation via information from a network of registered residents. If the system is combined with information from the National Institute of Infectious Diseases, which analyzes the incidence of diseases and provides the information to municipalities, municipalities could be informed of subtle developments in patients' conditions by themselves, which should improve communications with residents and monitor the sequence of an infectious outbreak.

*** Although patients with highly virulent new strains of influenza are basically expected to self-quarantine, information can still be collected via the app in the same manner as the basic system.**

Currently this system is being piloted in Yogyakarta, Indonesia, but it should be introduced to the rest of the country soon. The system itself can be used anywhere in the world. We are hoping to implement it in Japan after the successful pilot in Indonesia and eventually to the rest of the world beginning with ASEAN (Association of the Southeast Asian Nations) countries. Japan is always on alert for potential massive earthquakes. Currently, one weakness in disaster response is its lack of wide-area disaster management. Hence, establishing a multilingual disaster information system for local citizens, foreign residents, and tourists in Japan is imperative. We are trying to develop such a system under an industry–academia partnership and are seeking partnership and support with companies, embassies, and consulates.

8. Conclusion

From my investigation of a disaster, I have developed the system which can acquire disaster information also to people of many languages and multiple cultures.

However, we have not given still sufficient disaster information for people to many foreigners involved in a disaster on the spot. In the future, we think that we should have to simplify disaster information more. Moreover, we might to think the thing like the mark which cannot express disaster information with a text but can appeal against it visually is required. For example, I think that it is one with required offering information like the **triage** at the time of a health professional's accident and a disaster classified by color. Then, foreign people can understand and notice that the disaster information on that situation is the "Warning level" or the "Advisory level".

I think that we should make the visual mark which we understand by people of a country in the world.

[i] About CARED: http://www.respect.osaka-u.ac.jp/satellite-gadjahmada-en/program/cared/