Issues in the Use of the Recovery Watcher for Situation Awareness in Disaster and Inclusive Communications

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Abstract. Since the Great East Japan Earthquake and Tsunami in 2011, we have been working on how possibly IT could be used for disaster response and recovery in Japan. From this perspective, we implemented a system, Recovery Watcher, which was designed for sharing information on the recovery process with people inside as well as outside the disaster area. We also applied the system for barrier-free support in a university environment. This paper discusses the further possibilities to use the system for the first responders at disaster as well as inclusive support. We look into the original definition of situation awareness as well as trust issues. Finally, we present our plan to use the system in an island for elderly care as well as tourism in future.

Keywords: Situation Awareness, Information Sharing, Disaster Communications, Inclusive Communications.

1 Introduction and Motivation

The Great East Japan Earthquake and Tsunami on 11 March 2011, caused severe damage to the northern coast of the main island in Japan, and 15894 people died, 2546 are missing and 6156 are injured [1]. While we have had many natural disasters in Japan, only a few researchers in information processing have been working on the issue such as the use of IT for disaster management. The issue has been researched for long [2] [3]. At the disaster, while the inefficiency of the entire communication network was treated as the major problem for information exchange and situation awareness, we found another important problem that there was no information sys-tem available in Japan for immediate use in emergency response.

From this perspective, we try and implement systems to be used in disaster response and recovery so that we could see what could be usable at disaster. One of them is Recovery Watcher, an information sharing system to keep people being aware of how recovery goes in the disaster area by reporting images from the disaster area [5]. We reported its use for barrier-free information provision [6].

In this paper, we look into the related research on situation awareness to look at Recovery Watcher from this viewpoint. We report our recent development of Recovery Watcher in terms of inclusive communications as well as its issues. We present both

trust issues as well as our plan to use the system as a case study in the recovering area in northern Japan in Miyagi Prefecture. The paper is organized as follows. The next section introduces related work on situation awareness. Section 3 describes our work on Recovery Watcher and Section 4 presents its use for inclusive communications. Section 5 describes our future work on the use of our system in Miyagi. Section 6 gives some conclusions.

2 Situation Awareness

The term, situation awareness, was originally from aviation, in particular from aerial warfare, at which a pilot needs to know the current situation correctly to make a decision to achieve the goals [7][8]. The term is defined by Endsley as follows [7]:

"Situational awareness or situation awareness (SA) is the perception of environmental elements within a volume of time and space, the comprehension of their meaning, and the projection of their status in the near future."

Endsley introduced the three hierarchical phases of the above definition:

- Level 1. Perception of the Elements in the Environment
- Level 2. Comprehension of the Situation
- Level 3. Projection of Future Status

At Level 1, as the first step, one needs to perceive the status, attributes and dynamics of the relevant elements. At Level 2, based on the Level1, one has to understand the significance of those elements and events to form a holistic view of the environment. Based on the knowledge from Levels 1 and 2, one can project future actions in the near future.

Harrald et al. [9] summarized the above as situational awareness has an information component, a perception component and a meaning component. They de-scribed more about information component as follows:

"To provide the information component required for situational awareness, the system must be capable of collecting, filtering, analyzing, structuring, and transmitting data. Situational awareness is not only the correct perception of reality, it the correct perception of the relevant elements of the current reality necessary for correct, protective, tactical, and strategic response."

Situation awareness has been applied to the other dynamic and complex environment in which human control is required, such as air traffic control, large system operations such as nuclear power plant, and tactical and strategic systems such as firefighters, police and military as well as medical decision making [8].

Harrald et al. [9] describes that the knowledge acquired from the raw data should allow the decision maker to know the future implications of the current state, necessary interventions, the implied decisions to be made, and actions to be taken. The production of knowledge, along with the imputing of meaning, require trained, experienced receivers. They suggest that the following three steps required for shared situation awareness [9]:

1. technology can provide decision makers in a geographically distributed environment with the same information
2. common methods are available to integrate, structure, and understand the information
3. critical decision nodes share institutional, cultural, and experiential bases for imputing meaning to this knowledge

The first two steps are necessary for the common operating picture. They describe that shared situation awareness is required for military, firefighters and first responders.

3 Recovery Watcher for situation awareness

As we introduced in the previous section, IT could provide decision makers in a geographically distributed environment with the same information as the first step of the situation awareness [9]. Recovery Watcher was developed exactly for this purpose [6]. The original idea was to keep people being aware of what is happening at the recovery stage after disaster. It takes long to recover and reconstruct the towns and cities at disaster area, but the interests into such recovery and reconstructions would be faded out outside the disaster area as time goes by. On the other hand, we envisage the system to be used by the first responders at the early stage of disaster management cycle such as emergency response and even at the rescue phase [5].

In this section, we describe the original idea of Recovery Watcher in 3.1 and the use for the first responders in 3.2.

3.1 Original Idea of Recovery Watcher

Figure 1 shows the original model of the system. Cameras are located at multiple places in the disaster area. Images are to be uploaded to the server which provides the image sharing space.

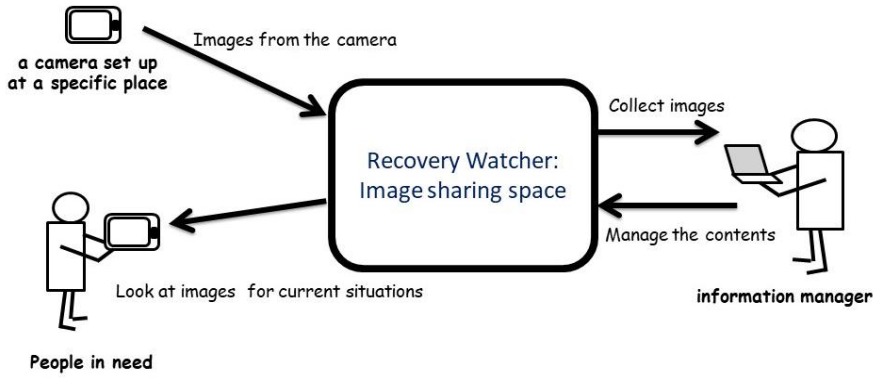

Fig. 1. The original model of Recovery Watcher

The first version of Recovery Watcher for Yamada town in Iwate Prefecture, Japan was set up as live-streaming making use of Ustream [10] for information sharing [6]. However, such video data took much bandwidth over the network, so that we changed into an image-based service with which some photo images would be sent periodically to the server system which acts as information sharing space. The frequency for uploading an image would be tuned accordingly.

Information sharing space could be presented on a map such as Open Street Map (OSM) [11] so that one can look them up thought the map. The information manager may control the uploaded sites so that if we add a new camera site, the new calendar will be prepared by the manager so that we control the camera sites. The users in need for such information on recovery situation in a disaster area would look up for the images, current ones as well as archives through the calendar.

3.2 Recovery Watcher for the first responders

The recovery watcher system was originally implemented for disaster recovery. However, we could make use of the system for rescue and response at the early stage of disaster management. We interviewed officers, doctors and volunteers who worked for the earthquake and tsunami emergency response in Iwate Prefecture at the Great East Japan Earthquake in 2011 and found that information for situation awareness is needed desperately for the first responders in the beginning of disaster including rescue and response operations [4, 12].

For the use of emergency response, the images need to be uploaded more frequently. We also need to take a picture on demand. Pictures sent from the local users would be of great help as well, so that we would need a function for those users to upload the images if they were in the disaster area. The information manager would need to manage the uploaded images. This part could be done by use of SNS. Hiltz and Plot-nick interviewed risk managers on the use of social media and found that trustworthiness is required for them to use social media [13, 14].

The trustworthiness of in-formation from SNS at disaster in Japan could be resolved by DISANA [15] which makes use of tweets from Twitter to present all the related information including bogus information; it is left for the user to decide what to believe. Indeed, Tanaka suggested the needs for critical thinking to decide whether to trust or not the received information [16].

In disaster management, “Levels 2: Comprehension of the Situation” and “Level 3.: Projection of Future Status” suggested by Endsley [7] are important and the decision makers need to be trained and experience for this purpose [9].

There are various kinds of disaster whose cases are different one another. It would be hard to expect that decision makers in disaster management are always trained and experienced in a specific type of disaster. Therefore, we may well need technologies such as Artificial Intelligence and deep learning to produce some suggestions to support the first responders.

4 Recovery Watcher for inclusive communications

We introduce the term, inclusive communications, to indicate communications between stakeholders of inclusive support, such as people with disabilities and their supporters. In this section, we report the use of Recovery Watcher for inclusive communications in the next subsection and related work on IT use for inclusive communications in 4.2.

4.1 Use of Recovery Watcher for inclusive communications

In Japan, according to Act for Eliminating Discrimination against Persons with Disabilities [17], a university is expected to provide the students with barrier free environment on a best effort basis. It needs a lot of effort in terms of human factors as well as budget to provide physical barrier-free environment such as a lift in old school buildings [18]. It may well be easier to implement software tools to provide people in need with information on barrier-free situations. From this viewpoint, we tried and used Recovery Watcher for inclusive support.

Indeed, situation awareness is required for such inclusive support. We reported the use of our system for barrier free support for the people with disabilities as well as their supporters to find out the situation of the university campus [5]. We firstly created an accessibility map based on OSM with a geotagged photograph sharing tool, Mapillary [19] and Wheelmap [20] including the information on slopes and toilets [21, 22]. Wheelmap, a wheelchair map system using OSM, shall be introduced later in the next subsection on related work. Our map is intended to share the information on accessibility with those who need barrier-free environment, those supporters at the university inclusive education support office and those who would report the current situation of a place such as how crowded the canteen is. Figure 2 shows the model of this system.

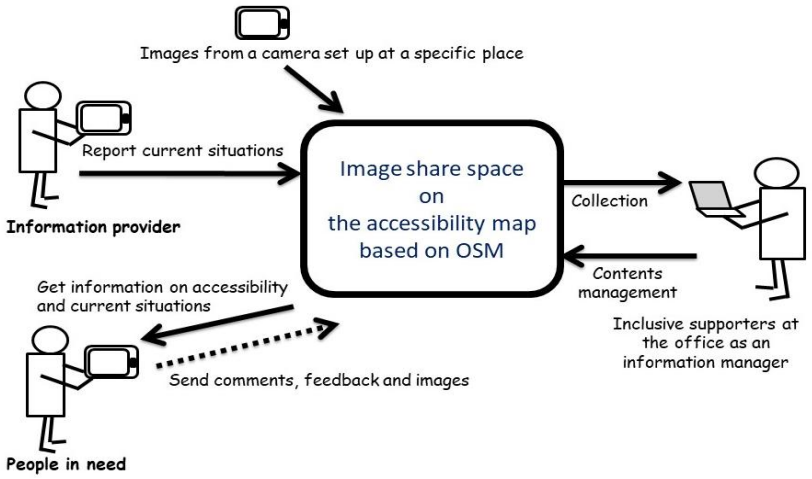

Fig. 2. The model of OSM-based accessibility map for inclusive communications

The difference from the original Recovery Watcher is “Information provider” who would upload images, which they take, as well as any comments. Indeed, “people in need” who look up for the information, may give some feedback comments and upload the images as indicated with the dotted arrow line in Fig.2, so that the information provided by the information provider could be confirmed by the user; it makes the information more trustworthy and reliable.

4.2 Use of Recovery Watcher for inclusive communications

The use of IT for inclusive support has been tried such as Wheelmap [22], which was developed, by a nonprofit organization in Germany, Sozialhelden e.V. and shows wheelchair accessible places on a map using OSM. Users can provide information on accessibility with three levels according to the number of steps and their heights. Photographs can be added as a part of information.

WheeLog created in Japan is a social barrier-free map to be shared by people with and without disabilities [23]. The system was designed from the viewpoint of people with disabilities. With a smartphone, one can trace the wheelchair route and indicate it on a map. The idea is if the route was traced, that route is presumed usable. Ministry of Land, Infrastructure, Transport and Tourism, Japan provides open da-ta on barrier free situations for application developments as a part of the Barrier-free Navi Project [24]. We could provide more useful information to use such open together with Recovery Watcher in future.

5 Future Work

We are planning to make use of Recovery Watcher in Tashirojima Island, one of the small islands in Ishinomaki, Miyagi Prefecture, Japan. The island was hit seriously by the Great East Japan Earthquake and Tsunami in 2011. It is so small as eleven km perimeter with approximately sixty three residents [25]. Although most of those residents are elder fishermen, they got together to make substantial recovery from the disaster [26]. The island is well-known as a “cat island”. Cats are taken care of by the residents and worshiped as a god of promising success in fishing, so that they have so many visitors who love cats from all over the world. While they used to have few guidebooks available to introduce the island, the information has been published through SNS and a web site [26]. Recovery Watcher could be of use for the elderly care as well as for tourism. Indeed, those applications are for situation awareness for different purposes. Recovery Watcher could be of use to such different purposes.

6 Conclusions

In this paper, we discuss the use of our system, Recovery Watcher, which was de-signed originally to observe the recovery process after the Great East Japan Earth-quake and Tsunami on March 11th, 2011.

We introduced the original definition of situation awareness and looked at Recovery Watcher from this view point. As introduced in Section 2, for situation awareness has three-level processes according to Endsley [7]. Recovery Watcher can only present the first level which is “Perception of the Elements in the Environment.” It requires the other levels 2 and 3, “Level 2. Comprehension of the Situation” and “Level 3. Projection of Future Status” based on the decision maker’s experience and knowledge. Those factors are required particularly for the use by the first responders. The experience and knowledge may well be required for the use for inclusive communications as well. For inclusive communications, we need the further research on whether those providers should be identified or not; alternatively, one can geotag the information at submission.

We also need the further research on privacy issue for Recovery Watcher so that we could provide suggestion on how to set up cameras. Currently we avoid to get the image of people. For elderly care, we need to look more into this privacy issue in future.

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