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Prototype of Paper Map for Practical Use of Regional Safety Map "Hamādo-map" and Its Questionnaire Survey

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Abstract: This paper describes making and evaluation of a paper-based regional safety map using the information of our community-based safety map creation support system. The purpose of this paper map is to raise awareness of disaster prevention by recognizing danger information in the local area on a daily basis. We extracted danger information from our system and imported it into an electronic map book Zi20 of Zenrin Co., Ltd. In addition, we have changed designs of icons displayed in the map and the information on hazardous areas. We have also added disaster prevention facilities and useful information in the event of disasters. These contributed to the creation of the A2 size regional safety map "Hamādo-map". We clarified issues for practical use of our safety map by conducting a questionnaire survey on the local residents in the target town and the city officials involved in disaster prevention in this area.

Keywords: regional disaster prevention, safety map, voluntary disaster prevention, historical local town, community participation

1. Introduction

Many Efforts have been made to deal with natural disasters that frequently occur in recent years (Disaster Management, Cabinet Office, 2015; Geospatial Information Authority of Japan (GSI). ,2017; ICTDSE2019 in ICCE2019, 2019; Mitsuhara, H., 2018). Hazard maps are attracting attention as a countermeasure against them. However, in local towns with historical streets (historical local towns) (Japan Guide.com, 2012), there are dangers in places such as old houses, narrow roads, and small waterways that do not appear as a standard when making hazard maps. It is desirable that these dangers are revealed from the perspective of local residents.

We set Hizen-Hamajuku, Kashima City, Saga Prefecture, where old townscapes from the Edo period remains, as a model district (Agency for Cultural Affairs, 2017; Saga Trip Genius, 2014). We have been working on practical development research on a system that supports creation of a regional safety map using ICT in cooperation with local voluntary disaster prevention organizations (Okazaki, Y., et al., 2016; 2017; 2018; 2019). The purpose of our project is not just making local disaster prevention maps but clarify the design of sustainable safety map creation that takes into consideration the information provision method and the validity of the information in collaboration with the local residents.

In this study, we create a paper-based regional safety map based on the danger information collected in cooperation with the community as part of the district's voluntary disaster prevention activities at Hizen Hamajuku selected as a model district. We clarify issues for practical use of the local safety map by conducting a questionnaire survey on general local residents and the city government officials involved in disaster prevention in this area.

The rest of this paper is organized as follows. Section 2 introduces our regional safety map. Section 3 describes results and discussion of the questionnaire survey. Section 4 gives summary of the paper.

2. Regional safety paper map "Hamādo-map"

2.1 How to Make the Map

Figure 1 shows the flow of the map creation process. We used an electronic map book Zi20 of Zenrin Co., Ltd. to create the map. We extracted the information (danger type, location information) of the dangerous spot collected by the previous activities from the database of our community-based safety map creation support system (CSV output) and imported them into the electronic map book Zi20. In addition, based on the results of previous questionnaires, the designs of icons indicating danger information were modified. The information of dangerous areas spread over certain areas was manually drawn and input while referring the program as Zi20 graphic information, because these are built into the system. Furthermore, description of icons (fire, flood, earthquake, and other dangers), information on low-lying land that is easily flooded, paths that may become inaccessible in the event of an earthquake, roads that fire truck cannot pass, and useful information for evacuation during a disaster are provided. This information was integrated and output as Zenrin's voluntary disaster prevention map (A2 version).

2.2 Overview and Components of the Map

Figure 2 shows the prototype paper map version of the regional safety map "Hamādo-map". This map provides information with icons and graphics based on Zenrin's map information. The danger location information is displayed with four types of icons (Fire, earthquake, flood, and other dangers). The information is 14 of the information collected by the local residents who walked around the town, which was determined to be high risk. As information on the dangerous area, a total of 39 pieces of information are drawn as graphics on a map. It includes flooding caution areas, densely-built wooden house areas, fire-sensitive areas, earthquake caution areas with soft ground, narrow paths that may be impassable when an earthquake occurs, and paths that fire trucks cannot pass through.

In addition to the data from our community-based safety map creation support system, three new evacuation centers (icons) and disaster prevention information useful in the event of a disaster (checklist for items taken out when evacuating) are provided.

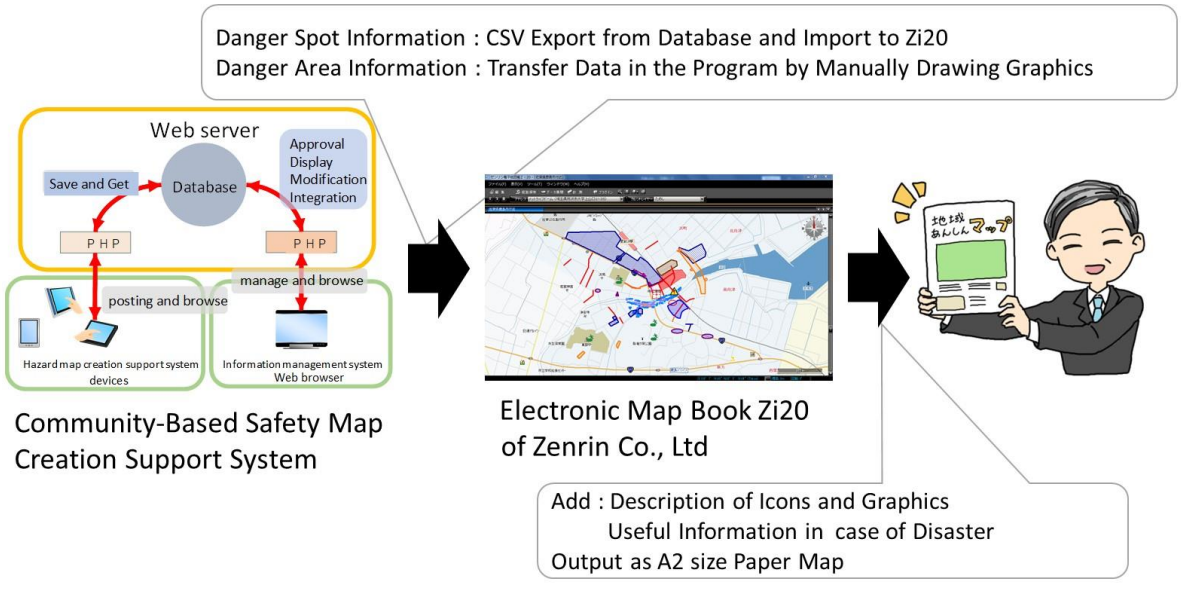

Figure 1. Flow of the map creation process

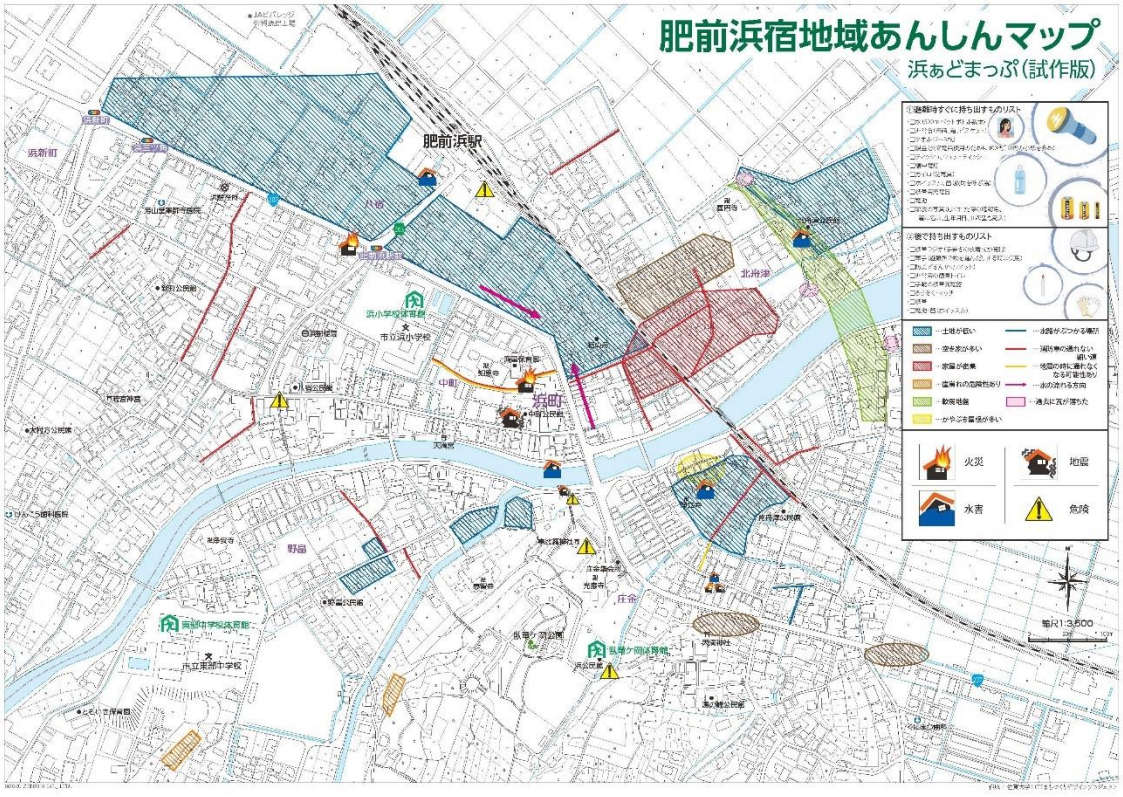

Figure 2. Paper map version of the regional safety map "Hamādo-map"

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3. Questionnaire Survey

3.1 Survey Method

A questionnaire survey was conducted from January 16 to 24, 2020. The subjects were 21 local residents of Hizen-hamajuku who came to the morning market or Hizen-Hama station, and 12 officials of Kashima City. We have not identified the respondents. Of the 21 respondents, 8 have experience using electronic maps. This indicates thaf they participated in map making or map-based workshops. The remaining 13 are believed not to be involved in our project.

The survey items of local residents are 14 items, which include age and gender, relation to our previous activities, comparison between paper maps and electronic maps, visibility and comprehensibility of maps, validity of information, and practicality of maps. The ones of the city officials are five items such as the visibility and comprehensibility of the map and the points to be improved in addition to their affiliation and recognition of our activities so far.

3.2 Survey Results

3.2.1 Results for Local Residents

A comparison between paper maps and electronic maps showed that two-thirds preferred paper (Table 1). Although there was demand for electronic maps, paper maps were generally preferred. About 80% have a positive evaluation of visibility (Table 2). On the other hand, for the comprehensibility, the icons, risks and other description were not sufficient, indicating that there was room for improvement (Table 3).

About the validity of the information, about three-quarters affirmed that it contained nearby hazard information that was not included in the hazard map (Table 4). On the other hand, there were negative opinions such as "There is little information described" and "There is no information that I think is dangerous". This suggests that it is necessary to review information collection and evaluation.

Table 1. *Comparison of Preference Between Paper Map and Electronic Map*

Which is better, paper map or Electronic one ?	Paper Map	Electronic Map
	62.5%	37.5%

Table 2. *Visibility of Offered Information*

(Visibility)		Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Disagree
Do you think the map is easy to see?	Local Residents	31%	50%	13%	0%	6%
	Citty Officials	9%	27%	36%	27%	0%

Table 3. *Comprehensibility of Offered Information*

(Comprehensibility)		Risk	Color	Font	Supplementary Description	Icon
Please choose the items that you think is easy to understand or appropriate.	Local Residents	18%	43%	18%	14%	7%
	Citty Officials	0%	33%	42%	0%	25%

Table 4. *Validity of Offered Information*

(Validity of Information)	Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Disagree
Do you think the map offer danger information felt in daily lives?	36%	29%	21%	7%	7%
Do you think the map offers you more information than official hazard maps?	37%	38%	13%	6%	6%

Table 5. *Practicality of Offered Information*

(Practicality)	Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Disagree
Do you think the map is useful for evacuation in case of disaster?	50%	25%	19%	0%	6%
Do you think the map helps raise disaster prevention awareness ?	57%	29%	7%	0%	7%

More than three-quarters positively evaluated the practicality (Table 5). The map was evaluated as useful for preparing for a disaster or for raising awareness of disaster prevention on a daily basis. This indicates that the practicality was able to obtain a certain appreciation.

3.2.2 Results for City Officials

Regarding visibility, only one-third of positive evaluations were made (Table 2). As for the comprehensibility, it was clarified that there was room for improvement in the comprehensibility of risks, descriptions, and the comprehensibility of icons, similar to local residents (Table 3).

We also received opinions and comments from the perspective of disaster prevention in this area. These include design of descriptions and icons, etc. so that the danger information on the map can be clearly conveyed, addition of evacuation routes assuming actual evacuation, and enhancement of posted information such as addition of useful telephone numbers in the event of a disaster.

3.3 Discussion

3.3.1 Visibility and Comprehensibility

This safety map aims to convey local danger information in an easy-to-understand manner. Residents say that it is generally easy to understand, but about a quarter of city officials are negative (Table 2). The evaluation of the printed information indicates that there is room for improvement in the way of conveying danger information, such as easy-to-understand risks (design of icons and graphics) and supplementary information for danger description and evacuation (Table 3). An analysis of the free description revealed that in addition to display problems such as the design of the icons and the colors of the areas at risk, the explanation of the meaning of the icons and the meaning of the location was insufficient.

The notation system has been used and shared so far by members of the district's voluntary disaster prevention organization through the activities. For the general public without such experience, it seems that there were parts that could not be easily understood. As a countermeasure, it is necessary to clearly explain the meaning of the information to be displayed in words, and to clarify the intention of the danger information described in the location. After that, the design of icons and other graphics for danger should be improved to make the contents intuitive and understandable.

3.3.2 Validity

The danger information in the safety map was reviewed at meetings of the local disaster prevention organization. From the danger information collected by local residents actually walking around the city with tablet terminals and the danger information newly added at meetings with the voluntary disaster prevention organization, danger information determined to be high risk at the meetings of the voluntary disaster prevention organization is printed.

We believe that we were able to collect a certain amount of information by collecting the information pointed out by the residents of each district while walking their own district. However, only one-time town walk for the entire district was conducted. In addition, it has been pointed out that the new dangers were noticed and some dangers were removed by countermeasures. We also found that there were individual differences in how people perceive danger. Based on these facts, it is necessary to periodically collect and inspect danger information as local disaster prevention activities, and to update the map while sharing the danger information in the region.

3.3.3 Practicality

This regional safety map was created with the focus of providing the collected danger information and raising awareness of disaster prevention. Since it is created on an A2 size paper map, it can be said that it has a high degree of browsing, and it has a certain level of practicality in raising awareness of nearby danger (Table 5). On the other hand, some respondents suggested that information such as evacuation routes, telephone numbers prepared for disasters, and information on evacuation should be added from the viewpoint of use as disaster prevention maps. In the future, it will be necessary to organize information that leads to actions after recognizing nearby dangers and print them in an easy- to-understand manner.

3.3.4 Differences in assessment between residents and city officials

There were differences in assessment between residents and city officials. We suppose the reason why the city officials evaluate lower than residents is they are in a position to protect the lives of residents. They are supportive of our project. We believe that the strict evaluation is due to strong expectations for practical and useful mapping of residents' perspectives.

4. Conclusion and Future Works

In this study, we created a regional safety map of A2 size paper map using the information of the community participation type local safety map creation support system, and evaluated it through a questionnaire survey. This regional safety map provides local danger information collected using tablet devices as local voluntary disaster prevention activities and the information pointed out at the voluntary disaster prevention meetings. As a result of conducting a questionnaire survey of local residents in the target area and city hall officials involved in disaster prevention in this area, the map received a certain rating in recognizing the danger information of the area by looking at the map and raising their awareness of disaster prevention. On the other hand, it became clear that there was room for improvement in the comprehensibility, validity of the printed danger information. In addition, we were able to obtain opinions and comments from the city officials involved in disaster prevention in this area, regarding the information provided, adding new information, and improving the supplementary information for danger description in the map.

As a future task, it is necessary to improve the comprehensibility of icons that indicate danger information and graphics of information on danger areas so that danger information is clearly recognized. It is also necessary to collaborate with local voluntary disaster prevention organizations to collect and select new information to be printed. Based on these, we will make improvements to include information that will lead to actual disaster prevention and evacuation actions.

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