DEVELOPMENT OF DISASTER IMAGINATION GAME BY USING SERIAL VIDEO

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Abstract

DIG (Disaster Imagination Game) is known as one of the risk communication methods in Japan. The participants who live in the same area surround a map of the area and discuss the disaster information such as the evacuation routes and the dangers that may lie around. They try to find not only the hazards but also the useful information like the location of the shelter. The detected information are illustrated in the map with pens and seals to visualize the risk and help. Thus the risk information in the area is shared with the participants. In this study, the new developments are proposed in which the serial video captured by MMS (Mobile Mapping System) is used as well as the map. The combination of the map and the serial video helps to detect the hazards. Moreover, the hazards detected in the workshop are illustrated not only on the map but also in the serial video by superimposing the displays and captions. The proposed system is expected to contribute to the spreading of DIG as more effective method of risk communication.

Keywords: education, risk communication, mobile mapping system

1. Introduction

DIG (Disaster Imagination Game) [1] is carried out as an emergency drill in Japan. What is DIG ? Assuming a situation where a large disaster occurs in the region, the predicted hazards are indicated in the transparent sheet which is put on top of the area map using pens and seals by the participants in a workshop. Thus creating the original hazard map in the area, the risk information can be shared in advance and the required preparation and cooperation can be recognized among the participants. Moreover, it is helpful to determine the appropriate location for the shelter and evacuation routes. The participants of DIG who live in the same area are usually divided into some groups and the leaders of the groups report the content of the discussion in each group in the end of the play. DIG is very effective as a pre-training for the disaster.

However, the hazards are often overlooked since planar maps are generally used in DIG and the participants are required to predict the hazards by their prior knowledge about the area and the information acquired from the map.

MMS (Mobile Mapping System) is a device to acquire the serial video along the path of the moving vehicle with an all-around view camera on it and the location information in the video. Though this device has been used in the surveying, TSUJIHARA *et. al*. applied it to the visualization [2] of the simulation of evacuation [3]. In this study, the new developments are proposed in which the serial video captured by MMS is used as well as the map. The combination of the map and the serial video helps to detect the hazards. Moreover, the hazards detected in the workshop are illustrated not only on the map but also in the serial video by superimposing the displays and captions. The proposed system is expected to contribute to the spreading of DIG as more effective method of risk communication.

2. MMS (Mobile Mapping System)

2.1 Hardware

MMS is the modular measurement system consisting of an all-around view camera, clinometer, GPS antenna, and their base units as shown in Fig. 1. Fig. 2 shows the car used in the measurement. The multi-camera system Ladybug3 made by Point Grey Research Inc. is used. It has six 2 megapixel cameras which allow JPEG-compressed 12 megapixel resolution images to be streamed to disk at 15 frames per second. Fig.3 shows the screen image of PC in the car. IMS (Iwane Mobile Mapping System) [4] is used in this study.

2.2 Software

2.2.1 Recording

The images shot by six cameras are recorded with the imformation of the location by GPS and the data of

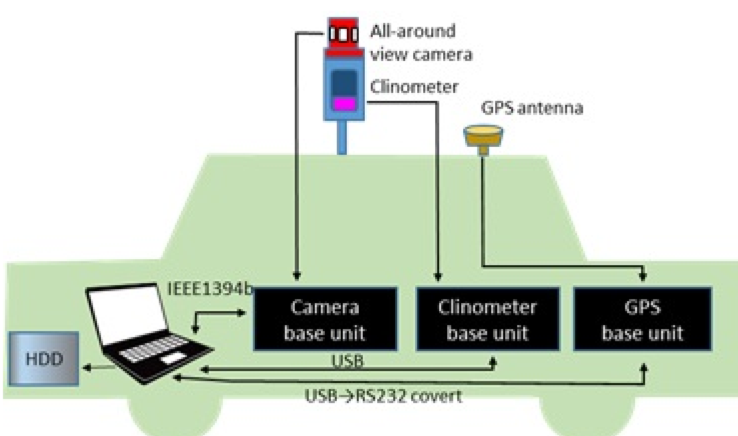


Fig. 1 – Mobile Mapping System

Fig.2 – Car used for recording

Fig.3 – Screen image

Fig.4 – Sample frame recorded by six cameras

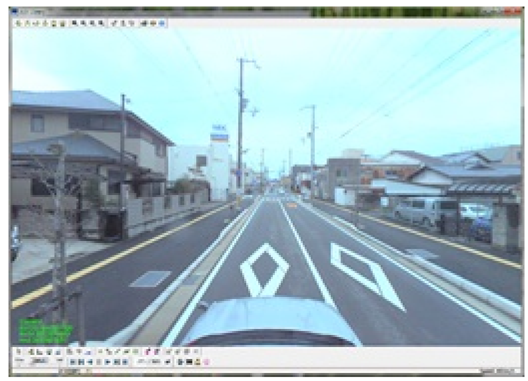


Fig.5 – Sample frame in Mercator projection

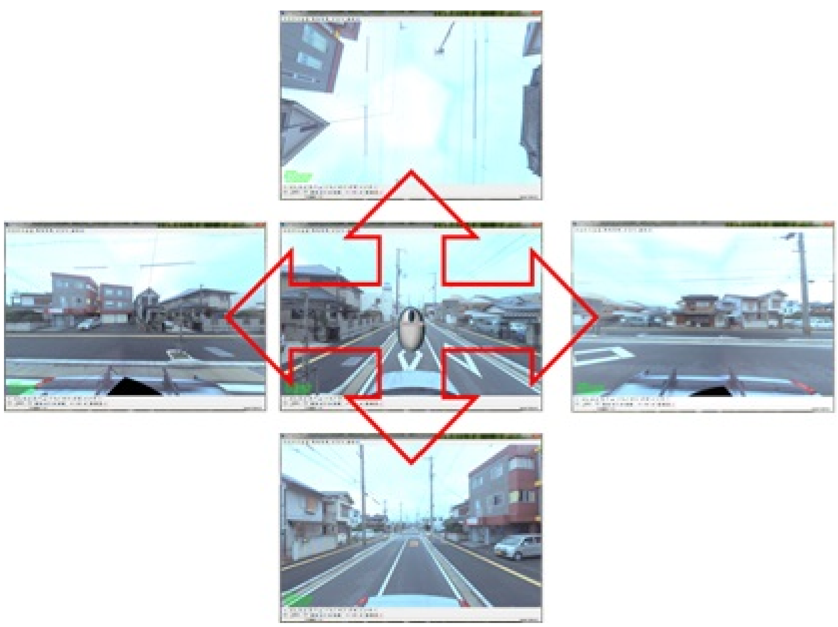


Fig. 6 – View point control

clinometer. Fig.4 shows a sample of the frames in which the composite imag is shown. It contains all pictures recorded by six cameras. It is converted to Mercator projection as shown in Fig.5. Though only a part of the

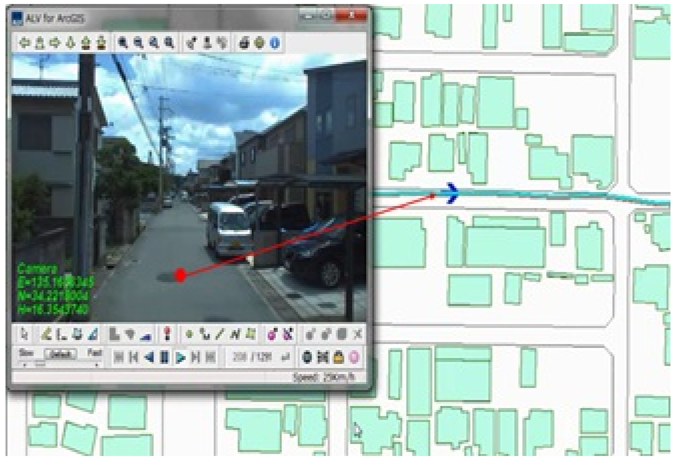


Fig. 7– Current location on the map

image in Fig. 4 is visualized in Fig.5, the 360-degree surrounding image can be seen by rotating the mouse cursor on the movie window in Fig.5 by right-drag as shown in Fig.6.

2.2.2 Camera vector operation

The position and the posture of the camera can be derived only from the information contained in a moving image sequences. By calculating the trajectory of the camera in 3D space, the position of features within the source image sequence is described. Thus calculated or derived position of camera and features has relative value and the scale is relative. The absolute scale can be given by calibrating with the actual coordinates (GPS) .

2.2.3 Creation of moving image

The pictures captured by the camera system are converted to the moving image. The global position of the frames in the image is given and the location can be shown in the map in parallel. Fig.7 shows a cut of the moving image and its location in the map. The locator, which is shown as an arrowhead, moves in the map along with the moving image and the map scrolls automatically.

3. Application to DIG

Fig.8 – Conventional style of DIG

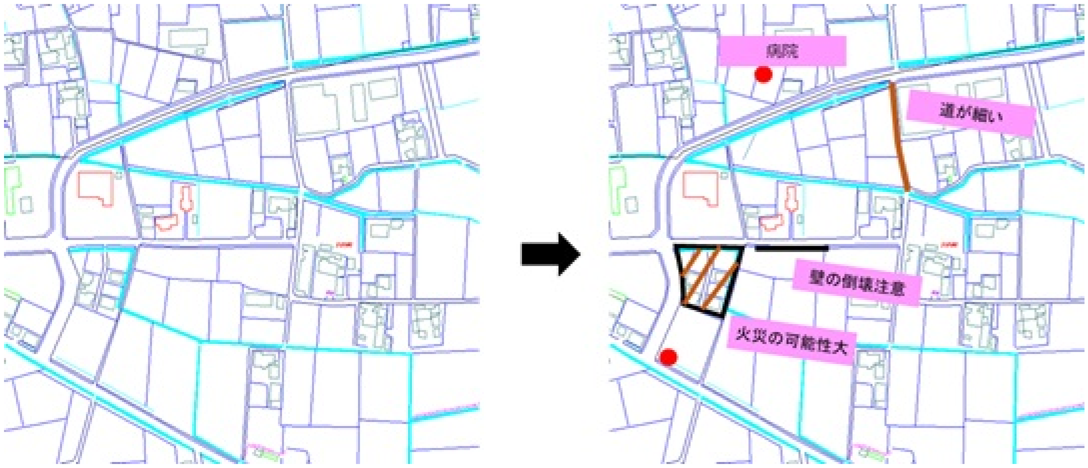
3.1 Support in detection of hazards

In the conventional style of DIG, the participants surround a map and illustrate the predicted hazards on the transparent sheet which is put on top of the area map using pens and seals, assuming a situation where a large disaster occurs in the region as shown in Fig. 8. In predicting the hazards, they refer only to the map and their memory about the area, so that it is very hard to covers the hazards without omissions.

(a) selection of both ends (b) measurement of height

Fig. 9 – Measurement using video

Fig. 10 – New style of DIG in detection of hazard



(a) before illustration (b) after illustration

Fig. 11 – Illustration of information on hazards in the map

Fig.12 – Sample of message board

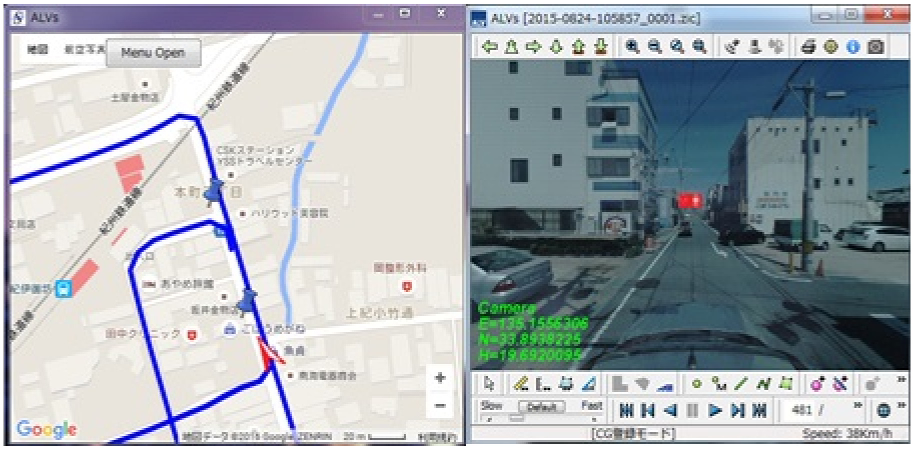
The image recorded by MMS is helpful to identify the hazards. Moreover, MMS enables the measurement such as the width of street and the height of wall. The measurement can be done directly from the captured video. Fig.9 shows an example to measure the height of wall. The value of height is shown by just selecting both ends in the video. The image of new style of DIG in detection of the hazards is shown in Fig. 10. The participants can refer to not only the map and their memory but also the live-action video. They may gain new understandings about the area.

3.2 Data mining in video

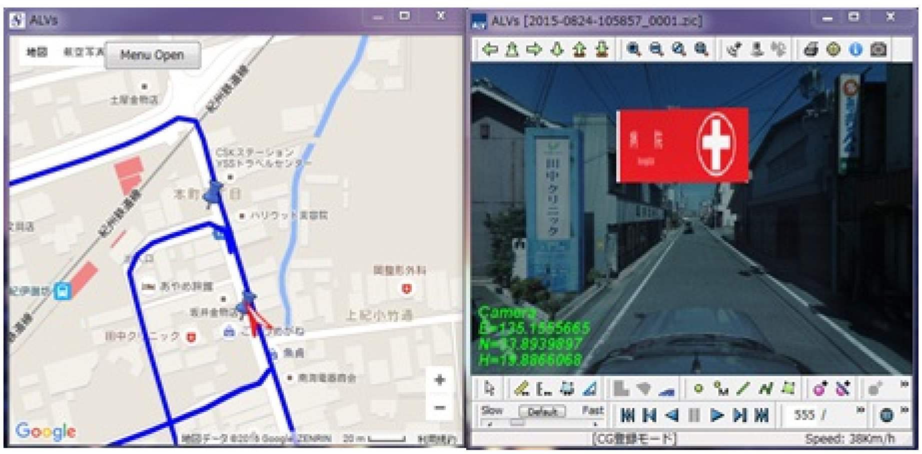
In the conventional style of DIG, the detected information about the disaster is illustrated on the map as shown in Fig. 11. Such visualization helps to keep those information in minds of participants. In the system proposed in this study, the message boards are prepared, and they can be stuck in the video easily. Some message boards are shown in Fig.12. Fig.13 shows the message board of a hospital as an example, in which the screen shot of distant and near view is illustrated in the video as well as the camera location in Google map. It is expected that the participants keep the information in minds more strongly by the presentation in 3D. Moreover by recording the results of the workshop as the electric data, they can be provided to other residents who cannot attend the workshop.

4. Conclusions

A new style of DIG (Disaster Imagination Game) is proposed, in which the serial video is used. It helps not only for the detection of the information on the disaster but also for the visualization of detected information in 3D space. Generally, residents do not participate much in disaster prevention training. DIG is no exception. Mostly limited residents such as senior or local self-governing body attend DIG. Younger residents seldom attend the drills. It is expected to broaden the participant base for DIG to the younger generation including children. However, the conventional DIG is not suitable to children, since map-reading is required. In the new



(a) Distant view



(b) Near view

Fig.13 – 3D visualization of information in video

style of DIG proposed in this study, video which is shown corresponding to the location of map helps map-reading. Moreover, the electric data in which the information on hazards is embedded can be provided to those who can not attend the workshop.

Acknowledgements

This study was supported by a Grant in Aid for Scientific Research under project No. 26350463.

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