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Invited Paper

Try to improvement of safety and security utilized security camera system considering privacy protection which led by the municipality

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Abstract. A stand-alone type security camera with privacy protecting function named "e-JIKEI Camera" is developed and tested in social experiments. In the e-JIKEI Camera, only the person who has the encryption-key, usually the police or city office, can decrypt and view the picture only when a crime or an accident occurs, and the picture will be overwritten in a week. Accordingly, the e-JIKEI Camera can be operated considering privacy protection. Additionally, an encryption method using two kinds of keys for detailed control of viewer's authority is proposed. We conducted social experiments using the e-JIKEI Camera.

1. Introduction

In recent years, security cameras have been widely accepted by society as a security system, and introduction of security cameras to shops, downtown areas, public facilities, etc. is proceeding. Also, since 2014, the movement to introduce security cameras into school roads by municipalities has emerged [1]. There is the number of crimes in a tendency to increase in the nation and the number of crimes reached about 3million cases [2]. In recent years, crimes aimed at children are increasing. Security cameras are necessary for school roads and places that are not very visible. However, the usage of security camera systems for crime prevention and criminal identification still has problems for protecting our whole society. First, these systems are usually expensive so they cannot be installed in many places. Second, concern about privacy invasion. Third, a typical system usually keeps watch only inside the owner's property; therefore, it cannot be used for the overall safety of the community [3, 4]. In order to solve such a situation, we propose "the e-JIKEI Network" with the concept of "to enhance the safety and security of local communities by setting security cameras densely in school roads and general residential areas, thoroughly protecting privacy". Therefore, we advocated "privacy protection by image encryption" and developed a security camera "e-JIKEI Camera (eJKC-ZB102c)". In the e-JIKEI camera, since images shot by the camera are encrypted and saved, it is possible to view images only when using dedicated viewer software. Therefore, it is possible to separate the owner of the image file and the viewer of the image. In this paper, we introduce the function and specification of the e-JIKEI Camera. In addition, I will explain the social experiment conducted in Midori-City, Gunma prefecture using this camera, describe the results and discussion, and state the importance and problems on consideration of privacy in municipal-led security camera system.

2. The e-JIKEI Camera: All-in-one type security camera system with consideration for privacy protection

The e-JIKEI Camera was developed in collaboration with a company (limited company Mazda Shoji). Figure 1 shows an external view of the e-JIKEI Camera. This camera system is an all-in-one

type security camera system with a built-in memory card that is thoroughly protecting the privacy of the person to be photographed. Therefore, it is not necessary to connect and manage the PC at all times, and wiring work is unnecessary and only power supply construction is sufficient. As a result, construction costs, operation costs and management are not need time and effort than the security cameras developed at the conventional the Society for the e-JIKEI Network. It is also developed on the assumption that it will be installed in high density and large quantity to local communities by administrative etc. Therefore, if it is installed in a high density similar to a streetlight in a school road or a residential area, it becomes possible to trace a criminal passing through the road and a wandering old man protecting the privacy of the local residents. In this way, the e-JIKEI Camera is suitable for introduction to residential areas, shopping streets, school roads, public facilities, etc. by function to encrypt which plays a role of privacy protection. It has waterproof performance for outdoor installation, video output for monitoring and pilot lamp which can check whether the camera is moving normally from the outside. Key information for encryption is recorded in the firmware, and is usually set by the administrator (municipality etc.) of the e-JIKEI Camera at the time of installation.

(a) Outside view of the e-JIKEI Camera (b) Behind view of the e-JIKEI Camera

Fig.1

3. Social experiment using the e-JIKEI Camera (eJKC-ZB102c)

3.1 Outline of social experiment

We conducted social experiment on security cameras in the vicinity of the four stations (Akagi Station, Azami Station, Iwajuku Station, Omama Station) in Midori City, Gunma prefecture. Under the cooperation of our laboratory and the Midori City municipal affairs department crisis management section, eight e-JIKEI Cameras were set up around each station. The experiment period is about one year from January 2015 to January of the following year.

3.2 Setting place of the e-JIKEI Cameras

Figure 2 shows each station where the camera was installed. As mentioned earlier, the total numbers of installed cameras are eight. The breakdown is that five e-JIKEI Cameras are installed at Akagi station, and others are installed one by one for each of Azami Station, Iwajuku Station, Omama Station.

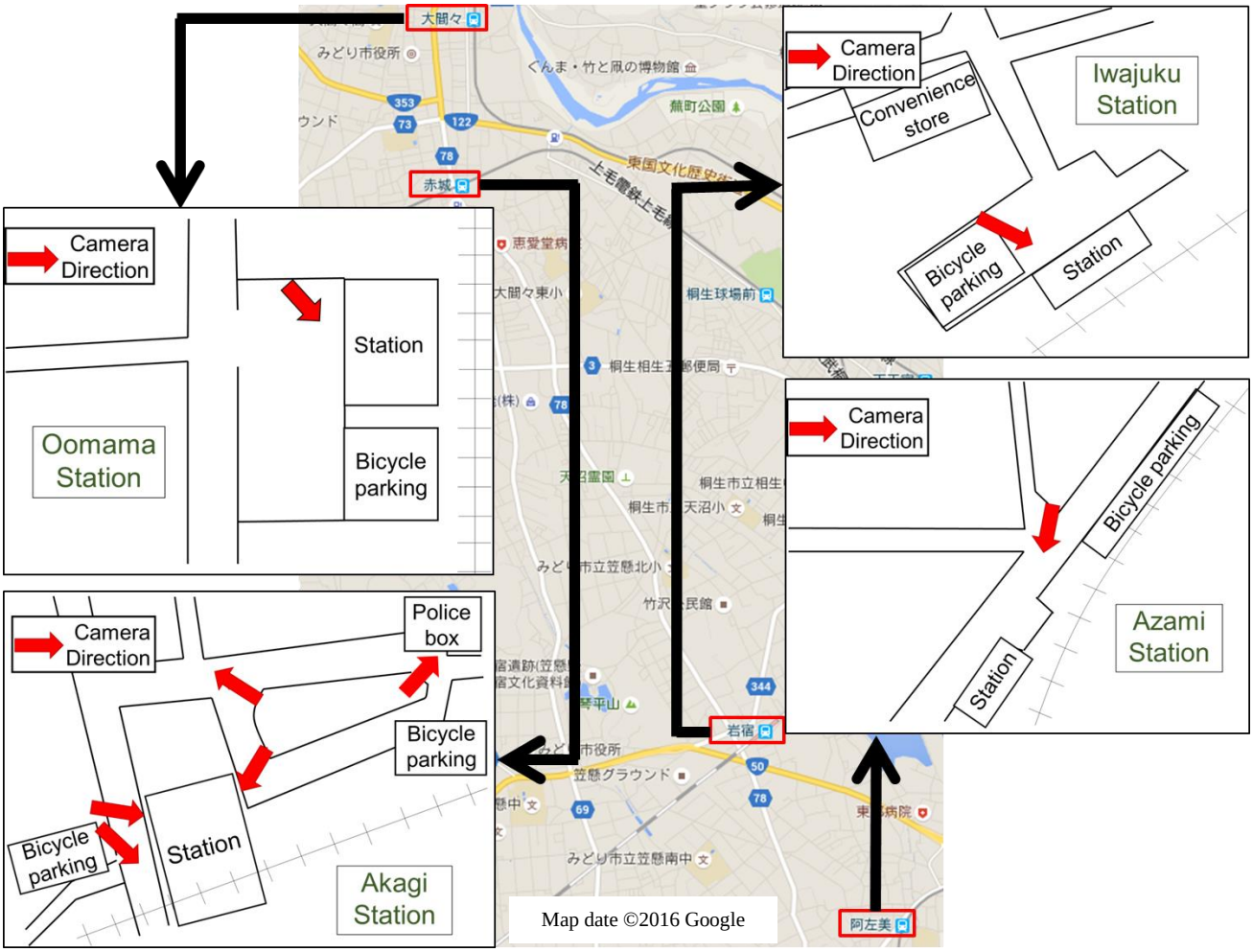

Fig. 2 Location of e-JIKEI Cameras in Midori City

3.3 System for the e-JIKEI Camera

Figure 3 shows the operation form of the e-JIKEI Camera in this social experiment. Since the e-JIKEI Camera is based on privacy protection as its main axis, it adopts an encryption method using two kinds of keys. This encryption method can distinguish browsers, so that people and places taken by the e-JIKEI Camera can not be seen by third parties. The photographed image is doubly encrypted with two decryption keys "Key-A, Key-B". Therefore, even if a third party illegally extracts the recording medium (SD card), since he does not know the decryption key and does not have dedicated viewer software, he can't browse the recording at all. Next, when only Key-A is entered, it is possible to view images subjected to mosaic processing like the image on the upper part of Fig. 3. It is displayed when an administrator or a maintenance contractor of the camera performs troubles correction or operation confirmation. Since mosaic processing is applied, the privacy of passersby and surrounding houses that may have been photographed is not infringed upon maintenance. Finally, when both Key-A and Key-B are input, a clear image as shown in the lower part of Fig. 3 can be viewed. This is displayed when an incident occurs in the vicinity of the camera installation site and there is a request for investigation cooperation. In this way, since no one can view the image except in a special case, it contributes greatly to privacy protection. When installing the e-JIKEI Camera, police, city hall, etc. hold key-A and key-B. Fig. 3 shows the operation mode of the e-JIKEI Camera in this social experiment.

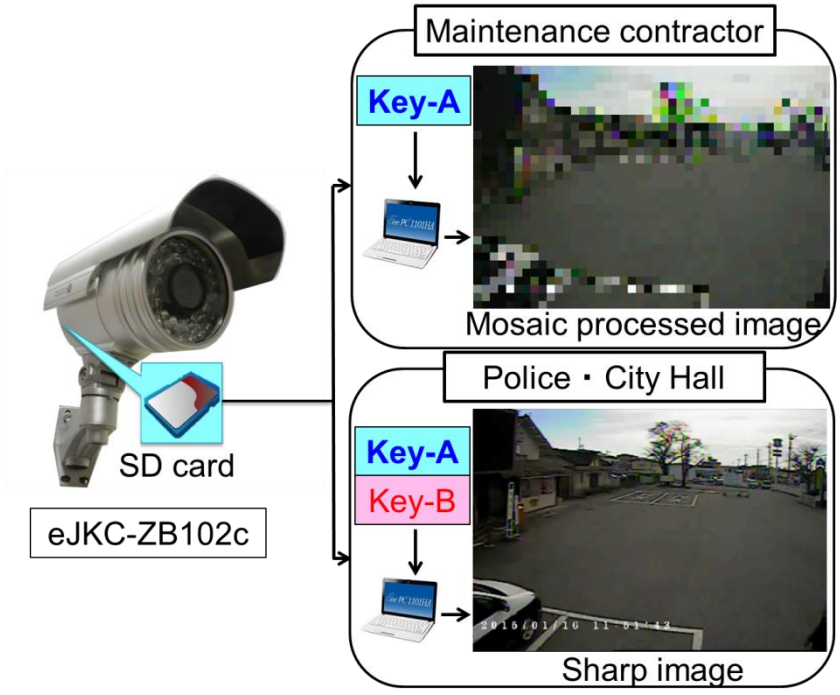

Fig.3 Diagram of usage of the e-JIKEI Camera

4. Result of social experiment using the e-JIKEI Camera

During the social experiment period, Problems such as the e-JIKEI Camera being stopped, the box containing the power supply part being difficult to open, and the work at high winds being dangerous because of being installed at a high place became clear. We conducted a questionnaire survey in the vicinity where the e-JIKEI Camera is installed area. As a result, approximately 70% of the respondents replied that the function of protecting the privacy of people in security cameras were effective. In addition, 60% of respondents said that cameras with privacy protection that can see clear images only when incident actually occurred were effective. And I got the answer that the e-JIKEI Camera can expect greatly in prevention of incidents and accidents that can occur in the surrounding area. The graph of the above result is shown in Fig. 4.

5. Discussion

In a social experiment of the e-JIKEI Camera at 4 stations in Midori City Gunma Prefecture, from the questionnaire survey conducted in the surrounding area, many respondents answered that security cameras needed functions to protect privacy. Security cameras are constantly shooting, there is a possibility that private life etc. may be reflected, which is considered to be resistant against being recorded everyday. Many people are interested in security camera with privacy protection function, and they think that the mechanism of the e-JIKEI Camera is useful. However, recognition and understanding of the privacy protection method "double encryption function" of the e-JIKEI Camera is not yet high. Further improvement of the e-JIKEI Camera is expected to promote mass and high density installation of it not only in major roads and stations, but also in residential areas and school roads. If the e-JIKEI Camera is installed as a crime prevention system that watches the area with high density in every place nationwide, it can protect the privacy of people that are taken unconsciously. And when an incident actually occurs, such as robbery, homicide, kidnapping etc. it will be possible to track suspects anywhere. We can expect to prevent the second and third crime by promptly identifying, tracking and arresting suspects. Moreover, if the crime prevention system of the e-JIKEI Camera spreads nationwide, it is thought that it will lead to suppression of crime.

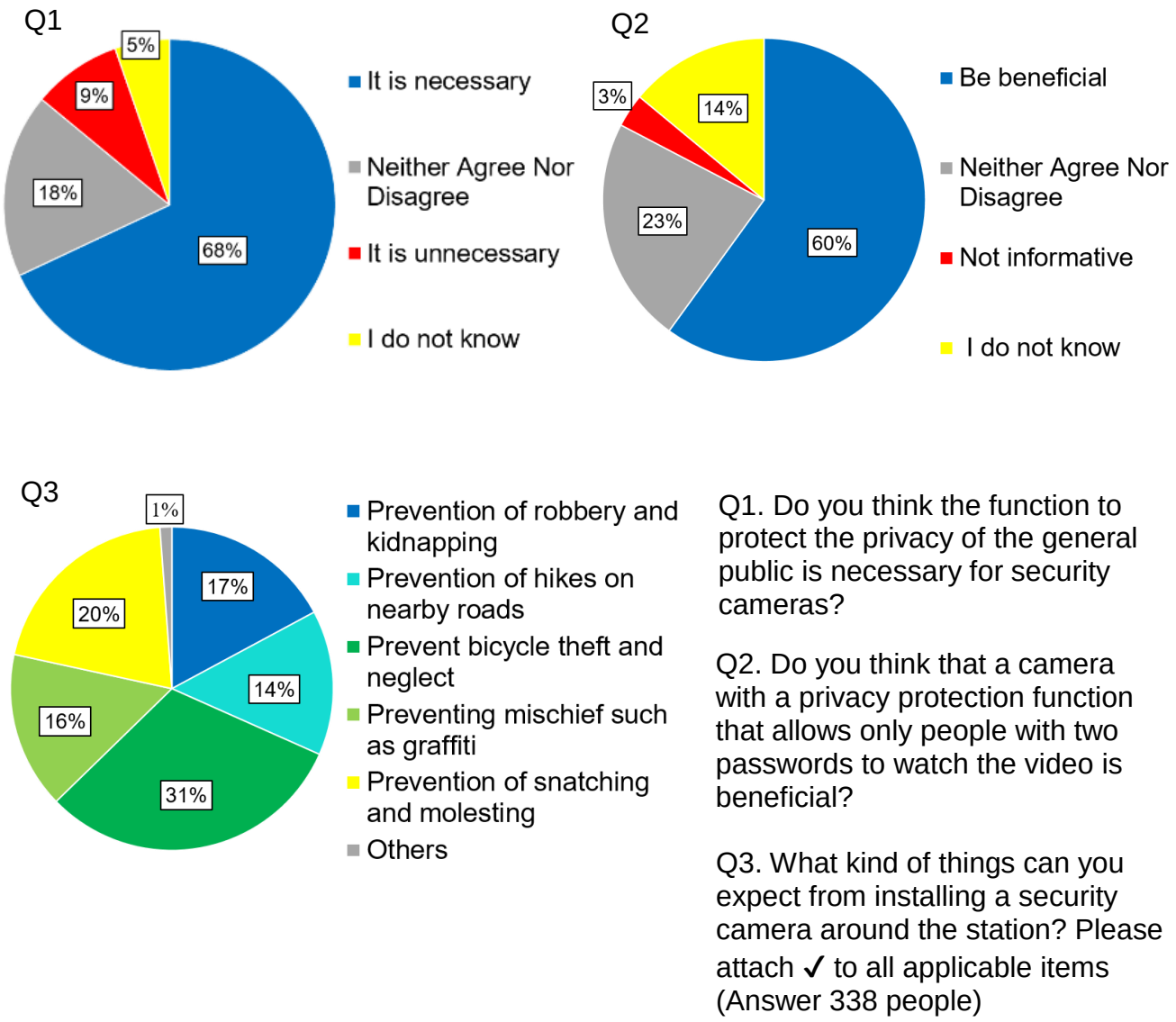

Fig.4 Result of questionnaire for residents. (150 respondents)

6. Conclusions

We have developed an all-in-one type security camera "the e-JIKEI Camera" with encryption method using two kinds of keys, and carried out social experiments. In the e-JIKEI Camera, the photographed image is double-encrypted and stored in the memory card, and only the viewer with the decryption key can decrypt the file and view the image. If the e-JIKEI Camera are installed at residential streets, school roads, roads, stations and so on at the same density as street lights, the e-JIKEI Camera will be able to trace suspects whenever an incident occurs. Moreover, it is not only crime prevention deterrent effect of crime prevention but also important witness when crime occurs. We would like to contribute to the realization of safer and more reliable national land by the e-JIKEI Camera by encouraging it high density and mass installation by publishing the press of the e-JIKEI Camera towards the whole country and disseminating information.

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