

Study on the required spacing of ceiling-mounted cameras

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Abstract. Molester on the commuter train is one of the major social problems in Japan. It is an urgent task to prevent the occurrence of victims of molestation crimes and false accusations of molestation crimes. The purpose of this study is to reliably record the crime scene of a molester crime by installing a high-density security camera on the ceiling of a train car, and thereby achieve the following.

- Specific and reliable identification of the criminal / criminal
- Crime deterrence by it

This research consists of the following two points.[a] We will experimentally evaluate the camera spacing and the certainty of identifying molester crimes for cameras placed on the ceiling of the vehicle at regular intervals in a grid pattern.[b] Based on the results of [a], we propose a specific camera layout. We also propose a privacy protection method.

1.Introduction

1.1 Molester crime on the train

1780 molestation crimes are arrested annually in Tokyo. 45% of them occur on the train.[1]

To solve this problem, Security cameras are being installed on some routes.

For example, the installation of security cameras on the Saikyo Line had the effect of reducing molestation crimes by 40%.[2]Despite the installation of security cameras ,molester crimes are still occurring on each line. The current problems are considered to be the scarcity of in-car security cameras and the lack of privacy protection. Currently, the number of security cameras per train is at most eight. If you take a picture of the whole vehicle with this number ,the shooting range becomes wider. If the shooting range is wide, it will be easier to check the overall situation. On the other hand, many blind spots occur due to congestion. Therefore, in a very crowded state such as a congestion rate of 200%, it is considered difficult to photograph individual molesters such as the current number of units and hand movements within the shooting range. While security cameras are installed, privacy protection is left to each company, and it is thought that a system that protects against unauthorized use is necessary.

To solve the current problem, it is necessary to deploy a security camera that can catch molester crimes without blind spots, prevent and arrest molester crimes.

Therefore, in this paper, we will experiment with camera placement to find molesters without blind spots. We will determine the required number of cameras and spacing through this experiment. In addition, by using the e-JIKEI Network Camera, the camera will be designed with consideration for privacy.

1.2About e-JIKEI net camera system

In recent years, with the spread of IoT, the spread of security cameras is increasing. As a result of the pursuit of public interest and profit, the arrival of a super-surveillance society that monitors and investigates all actions is expected. It is thought that this will improve the safety and efficiency of

society. However, protecting the privacy of citizens becomes an issue. In addition, it is necessary for the system operator to deal with unauthorized use. Therefore, our laboratory has developed an e-self-guard network camera with a privacy protection function.

This camera has a double encryption function and a complete memory of browsing activities. All images taken by this camera are double encrypted. People who do not have the encryption key cannot view the image. On the other hand, the administrator can view the image because he has the encryption key. In addition, the maintenance company can obtain another password, view the mosaic-processed image, and check the operation. With double encryption, there is no need to worry about anyone other than the administrator viewing the image. On the other hand, it is necessary to deal with unauthorized use by the administrator. Therefore, this camera has a complete memory function for browsing activities. All the browsing memory of the captured images is saved on the server of the third party. By disclosing this data to the outside, unauthorized browsing becomes clear. Therefore, it is possible to prevent misuse by the administrator. Privacy is protected by the above two functions. Utilizing this function, the safety of security cameras in railway vehicles is ensured.

2. System overview

Place the camera on the ceiling of the train like a grid.
That is, the cameras are arranged at equal intervals.
The camera is placed 1.60 m from the position of the human hand.
A system that can take pictures near human hands to capture molester crimes.
That is, a narrow-angle camera is used to narrow the shooting range.
This time, we will use a camera with an angle of view of 60 °

3 Experiment

Figure 1 shows the state of the experiment. Gradually shift the camera from directly above and verify that the state of the molester is reflected in the camera. Figure(a) is an image taken from directly above. Figure(b) is an image taken from a distance of 200 mm. Figure(c) is an image taken from a distance of 600 mm.

The assumed occupancy rate is 200%.The result of calculating the space per person at 200% is 350 mm². Through this experiment, the optimum spacing and number of cameras are determined.

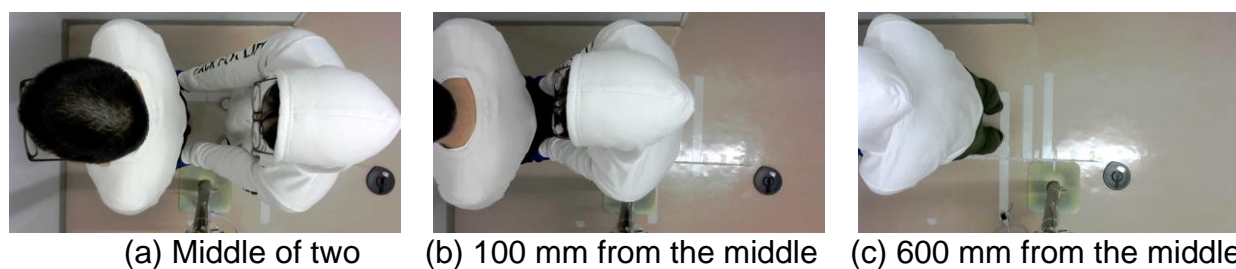


Fig. 1. Camera views of different camera position

4 Result

In order to capture the crime situation of a molester with a camera, it is considered that a large number of cameras are required so that it can be photographed from directly above. In addition, by narrowing the shooting range, it becomes possible to shoot individual head and hand movements in detail.

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Therefore, it is possible to record the occurrence of molestation. It is thought that the crime of molestation can be reduced by creating an environment where evidence remains.

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