

Detection and notification of illegally parked vehicles using the e-JIKEI network camera in monthly parking lot

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Abstract. We are developing an algorithm that automatically detects illegal parking in the monthly parking lot using a security camera. This time, as illegal parking, "parking in a preset uncontracted area" is targeted. The presence or absence of parking in the uncontracted area is detected by the "difference method". As a database for evaluating the motion detection algorithm, we prepare continuous shooting data for 24 hours. The 24-hour shooting data is created by moving vehicles in and out of uncontracted areas and contracted areas, and visually inputting the type, color, orientation, and stop time zone of the vehicle.

1. Introduction

In recent years, security cameras have been installed in stores and public facilities. In addition, the widespread use of the Internet of Things (IoT) can be expected to significantly reduce the cost required for all these security cameras to perform network functions. As a result of the pursuit of safety, public, and profit by the state, local governments, and companies, we can imagine the arrival of a super-surveillance society in which the actions and states of everything are monitored and recorded by their respective systems. While improving social safety and efficiency, it is pointed out that protecting the privacy of citizens is one of the greatest issues. It is important to prevent unauthorized use of photo data by the administrator of the security camera. [1, 2] Therefore, in our laboratory, we are developing a security camera "e-JIKEI network camera" with a privacy protection function. This security camera system is created using Raspberry Pi, which is a small board computer that can easily implement network functions and customization. This camera system is equipped with "double encryption of captured images" and "complete recording of browsing history" as privacy protection functions.

All images taken with the e-JIKEI network camera are doubly encrypted and no one without the encryption key can see the images taken by the camera. On the other hand, the administrator has a password and can view the image. In addition, the maintenance company can obtain a password from the administrator to display a low-definition image or display a mosaic-processed image to check the operation. [3, 4] The Concept "Complete recording of browsing records" is to record the browsing behavior of captured images, including viewers who have viewing authority, as browsing records on a recording server operated by a third-party organization. By publishing this browsing history online, suspicious browsing behavior can be quickly revealed. Therefore, it can be prevented from being abused by the camera administrator. [2, 5]

As described above, by using the e-JIKEI network camera system, which has the feature of being able to perform strong privacy protection by two abuse prevention functions, we decided to tackle the following problems.

2. Unauthorized parking on monthly parking lot

As the installation of surveillance cameras becomes more widespread, they may be installed with the expectation that troubles in parking lots will be suppressed. Among the troubles in the parking lot, in the case of parking without permission on private land, the police are likely not to intervene for the reason of civil non-intervention. In the future, it is expected that the number of cases where a system using a security camera is used to check for a violating vehicle, warn if there is a violating vehicle, and in some cases report it will increase. Therefore, the parking lot manager may need to check a lot of image data. There are concerns about omissions and browsing behavior itself caused by this. There are concerns about omissions and browsing behavior itself caused by this.

In this paper, we will apply an algorithm that use the e-JIKEI network camera on the demonstration site to detect parked vehicles and notify the administrator. we aim to enable the administrator to complete the minimum browsing activity and to allow parking lot users to use it with peace of mind without fear of privacy invasion.

3. Detection and notification method

For the detection of parked vehicles, a detection method using the background subtraction method is used. The background subtraction method is a method of extracting background from past images and discovering a moving object area from the difference between the currently captured image and the background. In this study, the vehicle is detected by comparing each pixel value in a particular area of the background image with the currently captured image. The image processing library OpenCV is used for the detection. Furthermore, when a vehicle is detected, a message is sent to an arbitrary destination together with the detected parked vehicle information.

4. Demonstration experiment site

Figure.1(a) shows the location of the e-JIKEI network camera on the social experiment site. In addition, Fig.1(b) shows a sample image taken by the e-JIKEI network camera at the demonstration experiment site. The uncontract parking space is shown as the area surrounded by the yellow lines in Fig.1(b). Detects and notifies whether the vehicle has stopped in an uncontracted parking space or in a contracted parking space. Detail will be explained at the presentation.

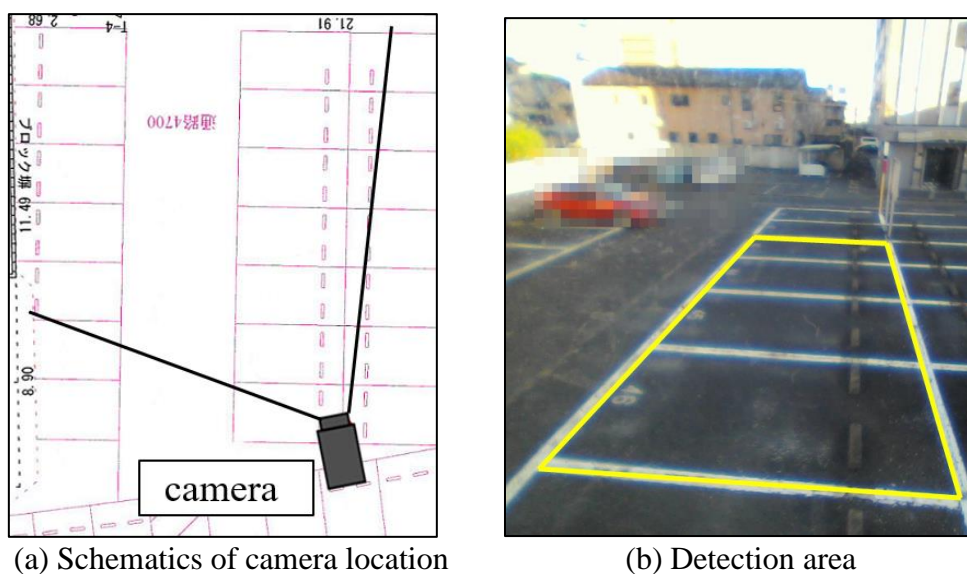


Fig. 1 Social experiment site

5. Algorithm evaluation

As a database for evaluating the motion detection algorithm, we prepare continuous shooting data for 24 hours. The 24-hour shooting data will be shot at the demonstration experiment site shown in Fig. 1. It is created by letting vehicles enter and exit the uncontracted section and contracted section, and visually inputting the type, color, orientation, and stop time zone of the vehicle.

6. Results

As the tendency of the background subtraction method, it is expected that a difference from the background image will occur due to changes in brightness due to shadows and sunlight, and shaking due to wind, resulting in false detection.

Notify only when detection is performed for a certain period of time. If the brightness value is significantly different from the background image, it is not considered to be detected. By taking such measures, we will endeavor to reduce false positives.

In the conference, the present status and the future prospect of the development will be discussed.

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