

論文 / 著書情報
Article / Book Information

題目(和文)	
Title(English)	A Wide-area Surveillance System Using Multiple Active Cameras
著者(和文)	ケイ玉冠
Author(English)	Yuguan Xing
出典(和文)	学位:博士(工学), 学位授与機関:東京工業大学, 報告番号:甲第10548号, 授与年月日:2017年3月26日, 学位の種別:課程博士, 審査員:長橋 宏,熊澤 逸夫,小池 康晴,山口 雅浩,小尾 高史
Citation(English)	Degree:Doctor (Engineering), Conferring organization: Tokyo Institute of Technology, Report number:甲第10548号, Conferred date:2017/3/26, Degree Type:Course doctor, Examiner:,,,,,
学位種別(和文)	博士論文
Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

論文要旨

THESIS SUMMARY

専攻：	物理情報システム	専攻
Department of		
学生氏名：	邢 玉冠	
Student's Name		

申請学位 (専攻分野)：	博士	(工学)
Academic Degree Requested	Doctor of	
指導教員 (主)：	長橋 宏	
Academic Advisor(main)		
指導教員 (副)：		
Academic Advisor(sub)		

要旨 (英文 800 語程度)

Thesis Summary (approx.800 English Words)

Nowadays, in order to make the cities more comfortable and safe, many countries have been promoting the smart city construction. One of the primary objectives is to realize advanced information analysis by obtaining data from various sensors connected via network. As the main sensor of smart city, the surveillance active cameras are widely used for crime prevention, disaster prevention, information analysis, and so on. However, separate control for each camera limits the entire system to play a more effective function. So it is still an important task to make camera cooperate with each other to improve the efficiency and convenience of the surveillance system.

This dissertation presented a wide-area surveillance system based on multiple PTZ surveillance cameras. In the conventional surveillance systems, each camera is independently controlled, and the operators have to watch multi-view 2D videos captured by dozens of cameras, so that the burden on the operators is heavy. In order to improve the surveillance efficiency considerably, it is necessary to integrate cameras installed at different positions by estimating their external parameters which refer to the relative position and the relative attitude.

In this dissertation, we proposed a new external parameter estimation method which aims at the features of the active PTZ camera. In this method, by using the L-shaped gauge, it is possible to estimate the external parameters based on the information of the optical axis, and avoid distortion of the lens and the displacement of corresponding points in conventional image processing method. In addition, since it is not necessary to calibrate the internal parameters, cameras can be operated to zoom in/out in accordance with a user's need during the estimation process. Once the external parameters are determined by this novel method, it is then possible to coordinate the motion of cameras at user's option.

By using the calibrated external parameters, the cameras can be controlled to measure the spatial information of the surveillance area and generate its 3D site model automatically. Based on this feature, even if some parts of the surveillance area have changed, 3D models can be updated timely and easily. In our proposed surveillance system, the coordinate system of the camera group is set as the world coordinate system, and 3D models are generated by system's own PTZ cameras, so the 3D site models and the cameras are described in the same coordinate system. However, in other methods, 3D models are generated separately, so they have to calculate the transformation including scaling, translation and rotation between the world coordinate system and the coordinate system of 3D models.

Then, in order to make good use of 3D site model and expand the use of surveillance system, we proposed a new position measurement method. In traditional method, at least two cameras are necessary to measure the spatial coordinates of a target. By contrast, because the 3D site model in our system contains the spatial information of the surveillance area, it is possible to obtain the spatial positions of targets by only one camera. With the spatial coordinates provided by one camera, we implemented the following two functions: dynamic 3D display and multi-view tracking.

The dynamic 3D display function means that the pedestrians can be displayed in a 3D

representation in real time. With this function, the operator can master the overall situation of the surveillance area by just watching the 3D site model. Therefore, it can provide a more intuitive feeling and reduce the operator's cognitive load. This function also makes sense even for the unmanned surveillance systems. For example, when some events occurred and people want to view the surveillance video at that time, the 3D videos can centrally show the information related to the events. Compared to watching 2D videos, people can more easily grasp the overall situation and get important information.

With the multi-view tracking function, one camera as the master camera provides the coordinate value of the target, other cameras can aim at the target automatically. If the target moves out of the field of view of the master camera, the camera which can still see the target is converted to the master camera so that it can continue to provide the coordinate value, thereby the target can be tracked by relays of multiple cameras. Utilizing this function, the system can continuously provide position information and enlarged images of the specific target. Needless to say, it is not necessary to track all moving objects. However, because there is always a master camera monitoring the entire region, the system does not miss any other information when multiple cameras are tracking a target.

Future work of this research includes the improvements on 3D site model, such as making models of wider scenarios and improving the integrity of the models. Moreover, some recognition techniques will be adopted to achieve 3D trajectory recording for specific persons.

備考：論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note: Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1copy of 800 Words (English).

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