A Panoramic navigation and Human Counting System for Indoor Open Space

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***Abstract*-- This research contains two major functions: one is the environmental guide, and the other is the human detection. The former utilizes the panoramic image to complete the panoramic view of the indoor space guide system including two floors. The latter uses a depth camera and image processing algorithms to calculate the number of people in a specific indoor area and provides instant updates and query records. In addition, the system provides a visualization graph to show the number of people in a given period, and to improve the utilization rate of the space.**

I. INTRODUCTION

During holidays, sometimes, you want to go out, because of the road to destination being far away and worrying about the destination crowded, so you dismiss the idea of going out. And then thinking of making a website tour guide, he opens the field in this room, using a panoramic camera to capture the image of space and a simple operation interface to allow users to do a view of the space guided action. Through this way, users know the environmental conditions of this location. However, considering whether the environment is crowded, the detection of human traffic is worthy of exploration. Therefore, this project uses depth image cameras to capture deep images, and then uses image process techniques to identify images, followed by calculating the number of people and recording the data in a cloud data base so that managers can use the obtained data analysis to improve the use of space.

II. SYSTEM DISPLAY

A. The Environmental Guide [1]

This feature uses the Kodak Pixpro SP360 4K Panorama Camera to plan the location of the shots in a floor plan, as shown in Figures 1 and 2. This project will take Chaoyang University of Technology Poding Memorial Library as a shooting scene. There are total of 6 shooting points on the first floor of the library, and 14 shooting points on the second floor. Photographing this specific indoor area is shown in Figure 3. After the photos have been collected in advance, the photos are taken by the Pixpro 360 VR Suiter, a Kodak official software, as shown in Figure 4; then let HTML5 display the panoramic image. The picture allows planning site layout, presents the page by jQuery and JavaScript syntax, then setting the specific location in the today's outdoor environment guide system. In order to simulate the user moving the panoramic image indoor, let the user feel experienced. In Figure 5, it is a panoramic view actually completed, where the user can drag through the mouse to rotate the panorama (left figure before rotation, and right figure after 90 degrees rotated), and can also use a mouse to click the arrow direction to switch to the ring view of another location as shown in the left picture of Figure 6. The computer screen in this screen is embedded in the hyperlinks of the library collection query as shown in the right picture of Figure 6, allowing the user to use various resources as in the actual library. The proposed navigation system integrates relevant online service information systems that the library can provide.

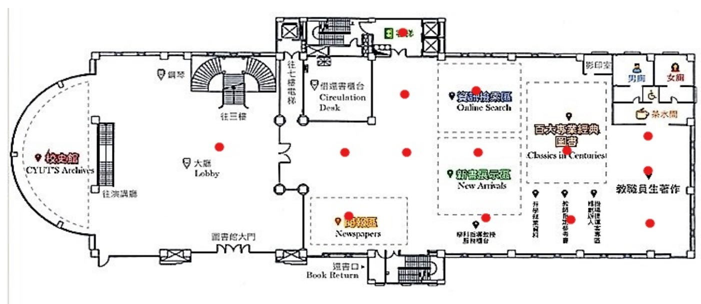

Fig. 1. The Planning tour route map of the second floor of the library

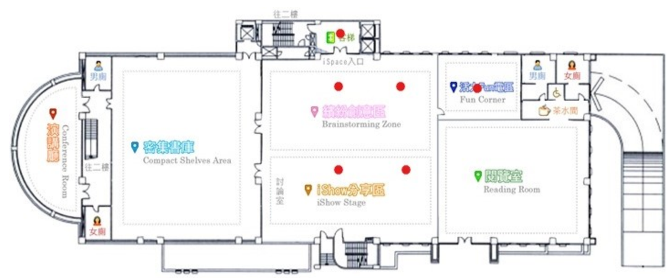

Fig. 2. The Planning tour route map of the first floor of the library.

Fig. 3. Pre-shoot picture.

Fig. 4. Panoramic Image

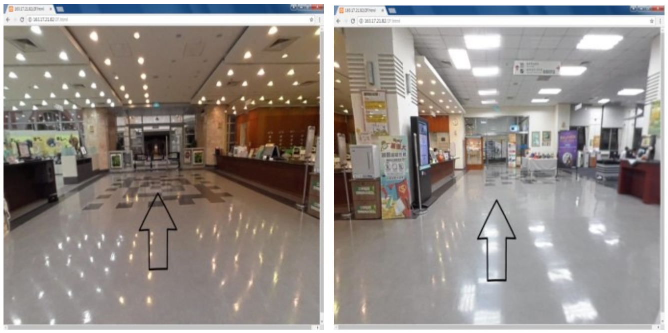

Fig. 5. Web version of ring views (0 degrees and 90 degrees).

Fig. 6. Web version of ring views (270 degrees) and information systems.

B. *The Human Counting [2]*

Use Xtion Pro Live to capture the screen, use background subtraction[3] to match the trained background to the captured image. After the noises in the picture are removed, Erosion and Dilation[4] are shown in Figure 7. However, the depth image will not be able to be completely segmented due to human overlapping. In order to solve this problem, we use the HAAR[5] function to find the face to help determine the image depth, combine two recognition functions, execute mark and count, which are recorded in the upper left of the RGB image with the current count of time, as shown in Figure 8. The number of counts will be stored in the database every 10 seconds to facilitate users' inquiries. Due to the limitations of the camera lens and its image capture function, this system is only applicable to empty space fields with less than ten people. In the future, better hardware can be used to meet the larger number of human counting requirements.

Fig. 7. Depth Image screen

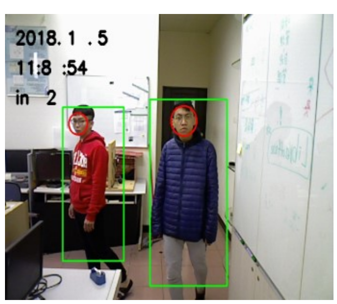

Fig. 8. Depth Image screen

As mentioned above, we use the built-in OpenCV[6] library, including Haar, expansion and erosion. The processing steps are described below:

Haar: Haar classifier uses the Boosting algorithm AdaBoost algorithm Just to cascade strong classifiers trained by AdaBoost algorithm, And in the bottom of the feature extraction, an efficient rectangular features and integral image method is used. Based on AdaBoost algorithm, face detections are done by using Haar-like wavelet feature and an integral image method. The main points of the Haar classifier algorithm are first to use Haar-like features for detections, and use the integral image to accelerate Haar-like feature evaluation; AdaBoost algorithm is then used to train a strong classifier that distinguishes face from non-face, and finally, a cascade of filters are used to cascade the strong classifiers together to improve accuracy.

Erosion and Dilation: it is the Dilation to expand the boundaries of object. The width of the Dilation is determined by the size of the structure element. If there is a small space between the objects smaller than that of the structural elements, Dilation can be the original separate objects connected. Erosion is the boundary of ablation objects. If the object is larger than the structural element, the result of erosion is to make the object thinner; the thinner width is determined by the size of the structure element. If the object is smaller than the structural element, the eroded objects will disappear. If there is a small connection between the objects smaller than that the structural elements, erosion will be split into two objects to find differences.

III. Conclusion

This study proposes two main functions: Environmental Guide and Human Counting. The former provides a panoramic view of the navigation function; the user can freely move the indoor open field and use the related electronic resources. The latter provides human counting for a specific indoor open space. According to the practical tests, it shows that the proposed system can effectively improve the ranking of a specific web page. The system allows users who are far away to experience the depths of the environment, and remote information functions integrated.

IV. REFERENCE

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