Smart Building: Smart Surveillance Security System

Tan Yi Jie[2*], Kannikka A/P Praset[2], Muhammad Azwan Sharif bin Hasnan[2], Nurain binti Zulkefle[2], Ruzelita Ngadiran[*1, 2] Nur Farhan Kahar[1, 2]

[1]Centre of Excellence Advanced Computing (AdvComp), Universiti Malaysia Perlis, 02600, Arau, Perlis, Malaysia
[2]Faculty of Electronic Engineering Technology, Universiti Malaysia Perlis, 02600, Arau, Perlis, Malaysia
Malaysia

[*]s181021182@studentmail.unimap.edu.my,[*]ruzelita@unimap.edu.my

ABSTRACT: This project aims to design a smart building by implementing a smart building with smart surveillance security system. Surveillance devices prove to be a great source of protection due to the exponential increase in burglary and theft activities. The smart surveillance system monitor the presence of human and performs a face recognition function to reduce the error caused due to motion detection. The PIR sensor will detect the motion and buzzer will act as an alarm to alert the unknown user. It notified the users when someone approached the smart building through a mobile application once the system completed the facial recognition process. The smart surveillance system developed using Raspberry Pi 3B+ has been successfully developed with the integration to mobile applications.

Keywords: *Surveillance System; Raspberry Pi; Face recognition; Mobile Application*

1. INTRODUCTION

Nowadays the society is filled with advanced and faster technology, which is more efficient for everyone in this culture. In this fast-moving society, thousands and millions of applications have been developed to accomplish activities. Moreover, advancements in recent technologies like 3G/4G networks help users connect to the grid from remote locations and enjoy a richer user experience with widespread social networking features [1]. However, law enforcement agencies usually encounter problems when it comes to public surveillance and suspect detection. Solutions for thwarting crimes can be very expensive and harder to implement. Therefore, cheap solutions for suspect detection are becoming more challenging to ensure public security—the proposed system steps towards modern public security solutions remotely cost-effectively in a smart and emerging building [2].

2. METHODOLOGY

This section will includes the design complexity and the flow of the project from zero to completing an application. The system is controlled by a controller Raspberry Pi 3B+ (RPi). The face recognition process will execute on RPi.

2.1 Design Complexity

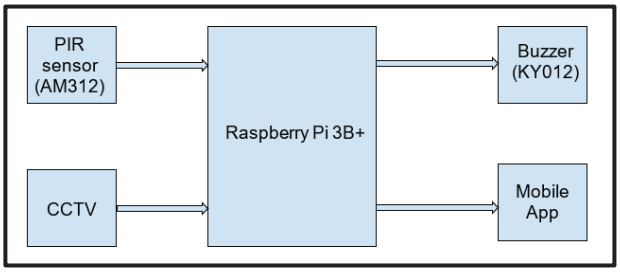

Figure 1 Block Diagram

Figure 1 shows the block diagram of this project. The system controls the RPi camera module to take human face image while PIR sensor catches human presence and buzzer alerts the unusual people. The detected face will be sent to mobile application built by Kodular [5].

2.2 System Architecture

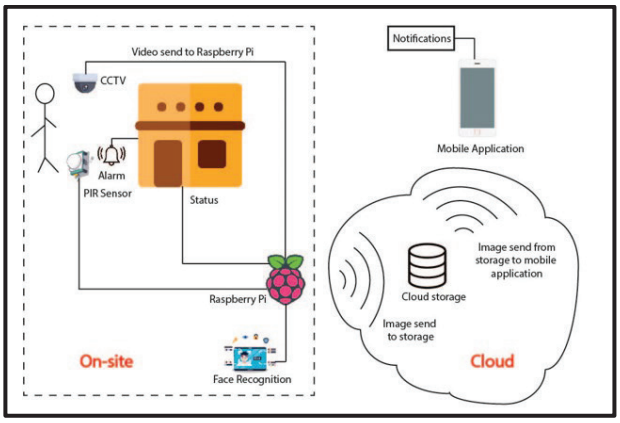

Figure 2 System Architecture

Figure 2 shows the system architecture. In this report, assumed that a people approached to the smart building, so that PIR sensor will work to identify human behavior, and it will turn on the buzzer, which act as alarm in this system. After that, the face recognition function in CCTV [3] performs and identifies the human face and the image will be captured and sent to the cloud storage Google Drive. Finally, the mobile application will notify the owner and send the images to the owner.

2.3 *Image Processing*

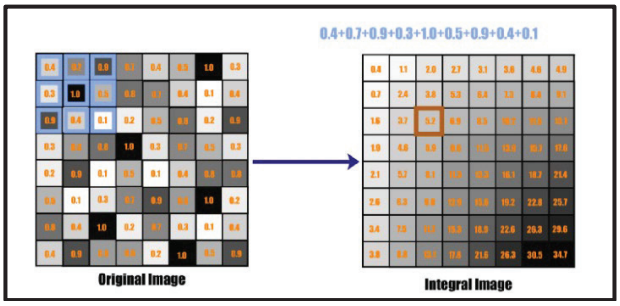

Figure 3 Original to Integral Image Process

Haar-cascade algorithm is implemented for the face detection purpose proposed by Viola and Jones in their research [4]. The general idea of the algorithm is to contribute the features to the image, makes it easy to find out the edges of the lines in the image. The first set of two rectangle features is responsible for finding the edges horizontal or vertical, shown in Figure 3. The second set of three rectangle features is responsible for finding out if a lighter region is surrounded by darker regions on either side or vice-versa. The third set of four rectangle features are responsible for finding out the change of pixel intensities across diagonals. A single rectangle on either side involves 18-pixel value additions (for a rectangle enclosing 18 pixels). This is the image transversal process required to get the haar features.

3. RESULTS & DISCUSSION

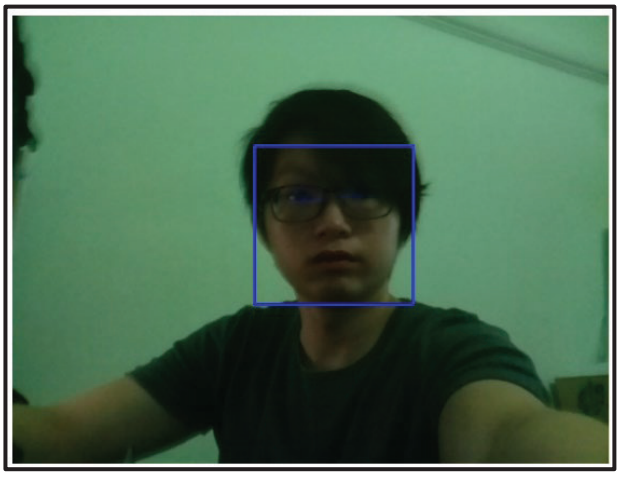

Figure 4 Face Recognition Result

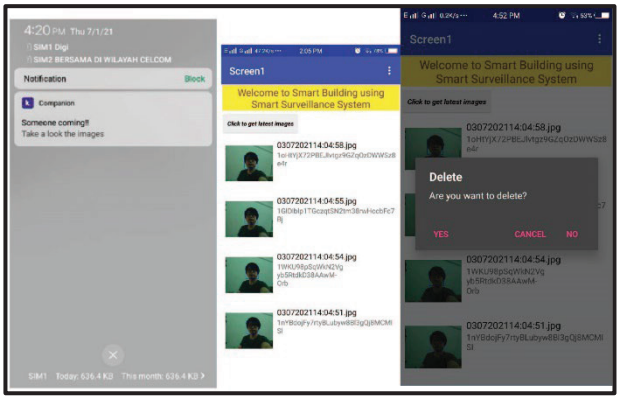

Figure 5 Mobile application received notification

Face detection shows the results of detected image and mobile application's notifications included in completing the project. The success rate was 100%. Figure 4 shows the face recognition result captured from the Raspberry Pi (RPi) camera. Figure 5 shows the mobile application received notification result while the image is captured, and the user can modify the content in Google Drive, such as deleting the images.

4. CONCLUSION

In conclusion, smart surveillance system is an effective approach to keep track of suspicious activity. The PIR sensor will detect motion and, based on the detected motion, turn on the camera, capture an image of the person, recognize it, and send a notification to the owner's smartphone based on the images uploaded in Google Drive. By using mobile applications, users can easily monitor who is coming to their building. Users can see the images of the person captured by the RPi camera module on the mobile application screen.

For future approach, the face registering function can be implemented for face entrance access to the system.

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