Implementation of Multiple Face Detection for Surveillance Systems

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ABSTRACT: Surveillance system such as closed-circuit television (CCTV) using Pan-tilt-zoom (PTZ) camera is able of changing the position of the scene by pan, tilt and zoom features. The downside of the camera is unable to capture the face clearly as it focuses on the static point of the lens. Thus, the purpose of the project is to develop a surveillance system that is capable to detect faces within the camera view. This project was developed by using LabView and Microsoft Visual Studio. The data from the camera and navigation system were implemented by using LabView whereas the face detection system was done by using both LabView and Microsoft Visual Studio. The performance of the face detection was examined by conducting various kinds of experiments, which include facial orientation, movement of the face, obstruction on face and light conditions. The accuracy was achieved at 89% and the system was able to detect a minimum of 10 faces in a view of a scene

Keywords: *PTZ camera; Face detection; LabVIEW*

1. INTRODUCTION

The surveillance system is the monitoring of the behaviour or activities to influence, manage, directing or protecting people. It can be used to observe the scene from a distance by using electronic equipment such as closed-circuit television (CCTV) camera. An IP (Internet Protocol) camera, also referred to as a network camera is a type of digital video camera often used for surveillance that can transmit and receive data through a computer network and Internet. An IP camera with the ability to pan, tilt and zoom is known as PTZ (pan-tilt-zoom) camera. This camera offers a wide range of areas to be captured at multiple angles and views. Most of the cameras can have more than 300 degrees pan and up to 180 degrees tilt. The movement of the camera can reduce the blind spot around the camera. The CCTV application is very broad in implementation that it can either be installed in a fixed location or on mobile applications including smartphone, robotic and vehicle [1]–[3].

The paper addresses the problem of surveillance cameras often unable to capture individual faces clearly while recording the scene. This is because there is an issue with the focus on the static point of the lenses. This leads to the playback getting blurry and unable to identify the person. Some studies facing a similar issue of detection on the face, but none of them is focusing on using PTZ cameras for a surveillance system. The implementation of algorithms in the PTZ camera is needed to control the observing area in a clearer view. Among all, the most prominent method for face detection in real-time is using Viola-Jones method [4]. In our study, we will use the Viola-Jones method on a PTZ camera to detect the face. The accuracy of the performance is important as it can be used as evidence in unexpected events [5].

This project aims to develop a surveillance system that is capable to focus on the detected face within the camera view. To achieve that, the listed objectives need to be completed, which were to configure the PTZ IP camera or manual navigation, apply the face detection algorithm in the camera view and evaluate the system performance for accuracy and reliability. This project mainly focuses on the implementation of the camera by using LabView. The application focuses on the implementation of face detection by using the Viola-Jones method and develops an autofocus feature. The facial features will be trained to increase the accuracy of face detection.

2. METHODOLOGY

To ensure the project can be developed systematically and smoothly, and overall project flow chart is proposed. This project started with capture the scenes by using a PTZ camera. When the scene is captured, it proceeded with face detection in real-time by using the Viola-Jones method [4]. Face detection undergoes features extraction to detect the presence of a real face. The flow chart in Figure 1 shows the flow of the project and the block diagram of the overall system is shown in Figure 2.

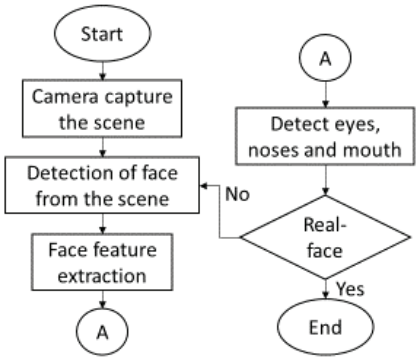

Figure 1: Flowchart of system development methodology

At the beginning of this project, the configuration of the PTZ camera was carried out to allow the laptop to

be directly connected to the camera. After the configuration is done, the camera was tested on LabView. Then, the features of capturing the scene and recording the scene were constructed. The images and videos were saved and stored in a selected location. After that, a navigation control was developed followed by the implement the Viola-Jones method to perform face detection [6]. A real face can be detected by using face feature extraction and a few experiments were carried out to test the accuracy.

Figure 2 Block Diagram of the overall system

In the process of face detection, training was needed to match the features of the eye, nose and lips [7]. The trained file was inserted into the Microsoft Visual Studio to carry out the coding of the face detection. Then, the coding was exported as a Dynamic Link Library (DLL) file. After that, the file was then used in the face detection block diagram in LabView.

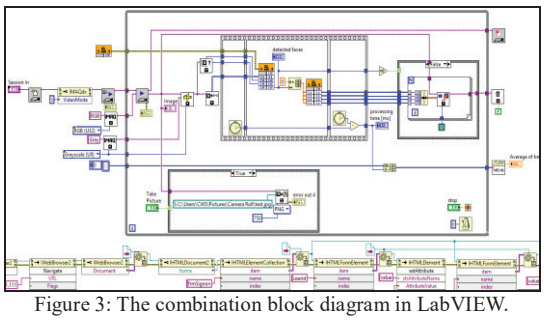

Figure 3: The combination block diagram in LabVIEW.

Lastly, the block diagrams of capturing picture feature, accessing navigation control from a web server and the face detection were combined to allow more performance function in one window. **Error! Reference source not found.** shows the combination block diagram develop in LabVIEW.

3. RESULT AND DISCUSSION

During the testing of face detection, the face can be detected almost immediately. Although the processing of detecting a face took about 115ms, however, the average time taken to detect a face was less than 0.001 ms. This had proven that the Viola-Jones face detection method is acceptable.

In the scene of the surveillance system, the situation of a place usually has more than one person. Therefore, the number of face detection was carried out to determine the capability of the face detection system. In this experiment, 10 faces were predicted by using the system and the result was observed. The result showed the system can detect at least 10 faces at the same time. Figure 4 shows the result of the experiment.

4. CONCLUSION

In this project, the face detection for the surveillance system in real-time was successfully developed by using LabView software. The objectives were achieved and the overall system performance accuracy was at 89% which was obtained from the experiments. The system was also able to detect at least 10 faces in a scene.

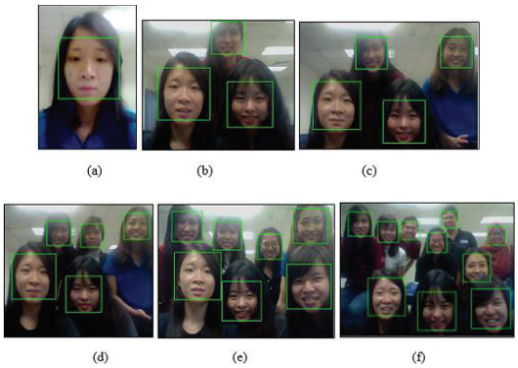

Figure 4: The experiment of faces detection. (a) one face, (b) 3 faces, (c) four faces, (d) 5 faces, (e) 7 faces and (f) 10 faces.

In future, this project can be developed into an advanced surveillance system by auto-tracking and face recognition.

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