Face Recognition System for Home Security

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Abstract - Security breach is one among the major concern today. The need for the safety is required everywhere from home to commercial, official and in defense also. Over the days the security is provided or accessing system is developed based on password, mechanical system and biometrical features. In biometrical based systems, fingerprint, iris, face detection and face recognition are used widely. This paper presents a new technique for human face recognition. This work is divided into three subsystems, namely face detection, face recognition and announcement of the human name through the voice-playback kit. Face detection is done by Viola-Jones method and face recognition is implemented by Scale-Invariant Feature Transform (SIFT) algorithm. Finally, if the face is already present in the database, then the speaker will be connected to say "She/he is at the door" due to the command of the Microcontroller. On the other hand, an alarm will ring for the unknown person.

I. INTRODUCTION

Nowadays, automatic person identification in control of access has become more popular by using biometrics information instead of using cards, passwords or patterns. The biometrics information has to be collected using fingerprint scanners, palm print scanners, DNA analyser etc. The first step of the face recognition system is face detection. The performance of the entire face recognition system is influenced by the reliability of face detection. The face detection techniques can identify only the facial part of an image. In this face recognition system, for the detection purpose Viola-Jones face detection method is used. Face recognition commonly includes feature extraction, feature reduction and classification. SIFT is one of the effective feature extraction method based on face as a global feature [1]. It effectively reduces the dimension of the image, and also it holds the primary information. In this paper, face recognition is implemented by using SIFT algorithm. The face detection and recognition part is implemented by using MATLAB installed on PC. The block diagram of the proposed system is shown in Figure 1.
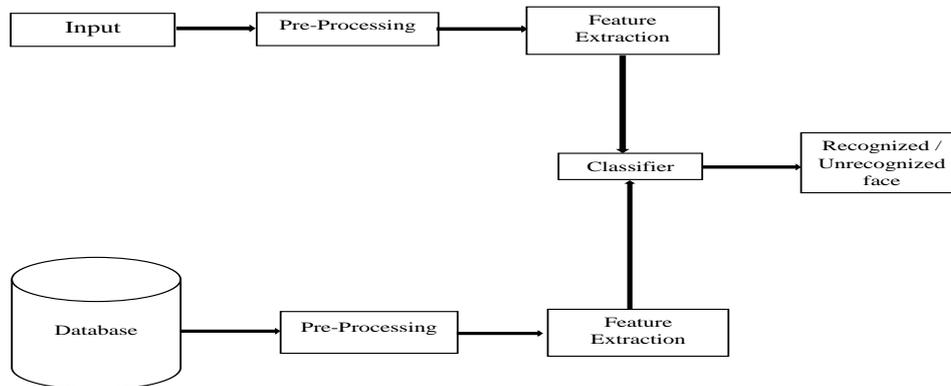

Fig. 1 Block diagram of Face Recognition System

II. SOFTWARE IMPLEMENTATION

The software section is implemented using MATLAB. In our interface, MATLAB is used for face recognition, in such a way that it matches the face from the predefined database with the image detected by the camera.

III. OPERATION

A. Face Recognition System

The face recognition system is capable of identifying or verifying a person from a digital image. The face recognition system consists of three major steps, detection of face, face features extraction and face recognition.

1) Detection of Face: Face detection identifies human faces in digital images. It is the first step in the face recognition system. In this step, face images are collected from the camera or image database. The collected face images should have the pose, expression, [2] etc. The performance of the face recognition system is based on the illumination condition,

background, lighting conditions and camera distance. Therefore, an input image is normalized and some of the image transformation methods are applied on the input image.

2) Extracting Face Feature: Feature extraction is the process of extracting relevant information from a face image. Feature extraction involves reducing the number of resources required to describe a large set of data [5]. At the end of this step, a biometric template is generated, which is stored in the database.

3) Recognition of Face: Once the features are extracted and selected, the final step is to classify the image [7]. The face recognition algorithms use a wide variety of classification methods such as PCA [3], LDA, and neural network classifier. In classification, the similarity measure between the real face images and the database images are calculated. Sometimes feature extraction and recognition process are done simultaneously.

IV. HARDWARE IMPLEMENTATION

The hardware configuration of our system is mainly based on Microcontroller PIC16F877A, USB to Serial Port Converter, MAX232 IC, Voice-Playback kit, Speaker, Audio Transformer, Buzzer and the USB to Serial Port Converter is used as the interface between the personal computer and the Microcontroller.

A. Microcontroller (PIC16F877A)

It has the features of serial communication interfaces, including Universal Serial Bus (USB) on some models, which are used for loading programs from personal computers. It is used for smart cards as well as for battery supplied devices [6] because of its low cost, low consumption, easy handling and flexibility. It is equipped with a set of digital and analog Input/Output (I/O) pins that may be interfaced to various expansion boards and other circuits. Figure 2 shows Microcontroller (PIC16F877A).

B. USB to Serial Port Converter

It is used to adjust the voltage level between the PC and the Microcontroller. It is a type of protocol converter which is used for converting USB data signals to and from other communication standards. Commonly, USB adapters are used to convert USB data to standard serial port data. Figure 3 shows USB to Serial Port Converter.

C. Voice-Playback Kit

It is a digital multi-message recorder with a maximum record time of 30-90 seconds. It can record a single or multiple messages and can be stored in on-chip Flash memory, provides non-volatile storage when power is removed. The Forward button is used to move sequentially through the recorded messages. The Play button is used to play all the messages sequentially. Onboard we have a microphone, speaker and a battery holder. Figure 4 shows Voice-Playback Kit.

Fig. 2 Microcontroller (PIC16F877A)   Fig. 3 USB to Serial Port Converter   Fig. 4 Voice-Playback Kit

D. Speaker

It is one of the most common output devices used with a computer system. It is also designed to work specifically with computers, while others can be used to any sound system. Speakers are used to converting the electromagnetic waves into sound waves. The speaker receives audio input from a device such as a computer or an audio receiver. Figure 5 shows Speaker.

E. MAX232 IC

It is an integrated circuit which consists of 16 pins, and it is mostly used in the voltage level signal problems. The MAX232 IC in the USB to a serial port communication system for the conversion of voltage levels that are interfaced with the PC serial port and the Microcontroller. It can communicate two systems simultaneously. Figure 6 shows MAX232 IC.

F. Audio Transformer

It is designed for matching the high impedance outputs of these amplifiers to low impedance loudspeakers. It can work at frequencies between about 20Hz to 20 KHz and are used in audio amplifier circuits. Figure 7 shows the Audio Transformer.

G. Buzzer

It is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric. It is used for alarm devices, timers, and confirmation of user input such as a mouse click or keystroke. Figure 8 shows the Buzzer.

Fig. 5 Speaker

Fig. 6 MAX232 IC
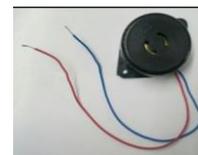

Fig. 7 Audio Transformer

Fig. 8 Buzzer

V. DISCUSSIONS AND CONCLUSION

In this paper, Automatic face detection and recognition is done by MATLAB program on Personal Computer (PC). The microcontroller is used to control the announcement of the person name depending on the incoming data sent from the PC. Voice is played immediately after confirming that the particular person is authorized. For face detection, Viola-Jones method is used to detect the location of the face in an image. To extract the important features of facial images with high performance, Scale-Invariant Feature Transform (SIFT) algorithm is used. Therefore, this work can be used in automatic recognition of people to improve high security for home.

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