International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Impact Factor (2012): 3.358

Design and Implementation of Ballot Malfunctioning System Avoidance Security Optimization

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Abstract: ***E-voting has been a very controversial topic ever since the presidential elections in the U.S. The aim of the project is to design a Electronic voting machine with maximum security facility by using Face Detection and Recognition system, bio-metric authentication technology and GSM technology. In Face Detection and Recognition system the voter's image is captured and it is compared with the saved photo from the database using Weber local descriptor algorithm and HAAR transform .In bio-metric authentication, the fingerprint of the voters is compared with the image in database. If the image is matched, then the voter polls the vote. The GSM modem sends the message alert to the election commission that to which party the voter has polled the vote.***

Keywords: Face recognition system, bio-metric authentication, GSM technology, HAAR transform, Weber local descriptor.

1. Introduction

Electronic voting in polling stations is in place in some of the world's largest democracies, and Internet voting is used in some, initially mainly small countries [3]. Many countries are currently considering introducing e-voting systems with the aim of improving various aspects of the electoral process [4]. E-voting is often seen as a tool for advancing democracy, building trust in increasing the overall efficiency of the election process. The election committees, international bodies and standardization bodies are continuously updating their methodologies and approaches.

E-voting can occur in controlled and uncontrolled environment [2]. In controlled environments e-voting happens when the casting of votes takes place under the supervision of staff appointed by the electoral management body. By that means the election administration can to a great extent control the voting technology as well as the procedures and conditions under which voters are casting their ballots [5]. E-voting in controlled environments can be seen as the electronic equivalent of traditional paper-based voting in polling stations, embassies and so on. E-voting in uncontrolled environments happens without any supervision and from voting devices that cannot be controlled by the election administration. E-voting in uncontrolled environments can be seen as the electronic equivalent of postal voting or absentee voting.

2. Existing System

The existing system presents the design of a novel electronic voting machine using microcontroller. Voter's information is stored in the machine. The number of voters present at the polling place is stored in a register and used to do various analyses later [1]. So, the counting time is more. Infrared sensors have been used for determining the voter's information. The voting machine designed here has vote rejection option. The system is developed using PIC16F877A. PIC16F877A microcontroller based on the modified Harvard architecture developed by microchip technology is used. It is a 40-pin dip having low power consumption. It has 256 bytes EEPROM memory and high speed FLASH/EEPROM technology [7]. There is a synchronous serial port in the microcontroller used here which is configured either as a 3-wire Serial Peripheral Interface or a 2-wire Inter-Integrated Circuit bus and a Universal Synchronous Asynchronous Receiver Transmitter. A microcontroller is a basically a single integrated circuit which has CPU in addition to a fixed amount of RAM, ROM, I/O ports and needs minimum of support chips.

3. Proposed System

In Face Detection and Recognition system (FDR) the voter's image is captured by using a webcam and passed to a face detection algorithm which is used to detect the face from the image and it is compared with the saved photo from the database .The `detection algorithm used here is Weber local description algorithm and the transform used is HAAR Transform. In bio-metric authentication finger print sensor gets the finger print of the voters and sends to the PC. If the image is matched, then the pc sends a message to the microcontroller that the person is authenticated after which the voter can poll the vote [8]. Next, the GSM modem sends the message alert to the election commission that to which party the voter has polled the vote. So, the counting process can be made faster and gives acknowledgement to the voter. The microcontroller used here is ARM7.

The block diagram of the proposed system is shown below.

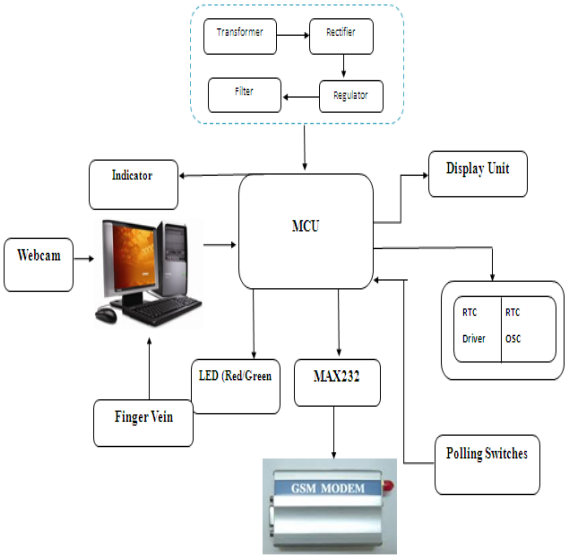

Figure 1: Block diagram of Proposed System

4. Face Recognition System

The identification of objects in an image would probably start with image processing techniques such as noise removal, followed by (low-level) feature extraction to detect certain textures. Reduce the image to a series of numbers that can be manipulated by the computer in order to digitally process an image [9]. A picture element or pixel is the brightness value of an image at a particular location. The pixel value of a digitized image may be 512 × 512 or 250,000 pixels.

4.1 Face Recognition Based On DCT Feature Extraction

In the field of image processing and recognition, discrete cosine transforms (DCT) and linear discrimination techniques are used. Based on these techniques a new face and face recognition approach is proposed in this paper. It first uses a two dimensional DCT to select the DCT frequency bands with favorable linear seperability. Then from bands that are selected, the linear discriminative features are extracted by an improved Fisher face method and nearest neighbour classifier is used for classification.

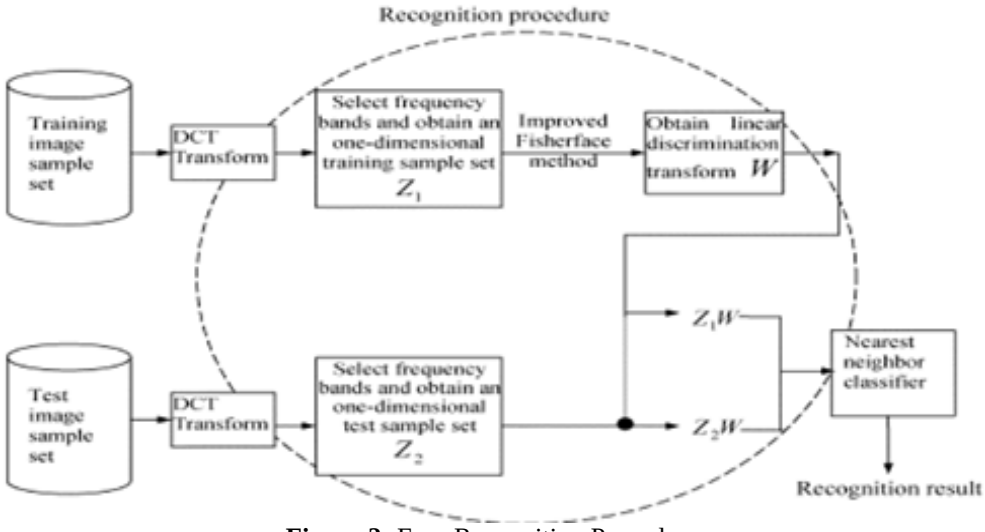

Figure 2: Face Recognition Procedure

4.2 HAAR Transform

Conventionally, Fourier transform has been used extensively to analyze the spectral content of a signal. However, Fourier transform is not able to represent a non-stationary signal adequately [6]. HAAR transform provides a simple approach for analyzing the local aspects of a signal. The HAAR transform uses HAAR function for its basis. The HAAR function is an orthonormal, rectangular pair. Fourier transform basis function differs only in frequency, whereas the HAAR function differs in scale and position.

The family of N HAAR functions $\mathrm{h_k(t)}$ are defined on the interval $0 \le \mathrm{t} \le 1$. The shape of the Haar function, of an index k, is determined by the following equation

$$\mathrm{k} = 2^p + q - 1$$

and k is in a range of $\mathrm{k} = 0, 1, 2, \cdots, \mathrm{N}-1$.

Whenk $= 0$, the Haar function is defined as a constant $h_0(\mathrm{t}) = 1/\sqrt{N}$; whenk > 0, the Haar function is defined as

$$h_k(\mathrm{t}) = \frac{1}{\sqrt{N}} \begin{cases} 2^{p/2} & (q-1)/2^p \le t < (q-0.5)/2^p \\ -2^{p/2} & (q-0.5)/2^p \le t < q/2^p \\ 0 & \text{otherwise} \end{cases}$$

4.3 Weber's Local Descriptor

Weber local descriptor represents an image as a histogram of differential excitations and gradient orientations, and has several interesting properties like robustness to noise and illumination changes, elegant detection of edges and powerful image representation.

WLD descriptor is based on Weber's Law. This law states that the ratio of the increment threshold to the background intensity is constant. Inspired by this law, Chen et.al proposed WLD descriptor for texture feature extraction. The

computation of WLD descriptor takes place in three steps i.e. differential excitations, orientations of gradient and histogram building. Weber's Law, can be expressed as:

$$\frac{\Delta I}{I} = k,$$

Where ΔI represents the increment threshold (just noticeable difference for discrimination); I represents the initial stimulus intensity and k signifies that the proportion on the left side of the equation remains constant despite variations in the I term. The fraction ΔI/I is known as the Weber fraction.

5. Fingerprint Recognition System

A fingerprint shown in fig 7 is the feature pattern of a finger. Each fingerprint is unique and every person has their own fingerprints with the uniqueness that is permanent. For this reason fingerprints are used for identification and forensic investigation. A fingerprint has many ridges and furrows. These ridges and furrows have similarities in small local window, such as parallelism and width. In fingerprint recognition, fingerprints are distinguished by Minutia and not by ridges and furrows. Minutiae are some abnormal points on the ridges. There are various types of minutiae among which termination and bifurcation are widely used. Termination is the immediate ending of a ridge and bifurcation is the ridge point from which two branches derive.

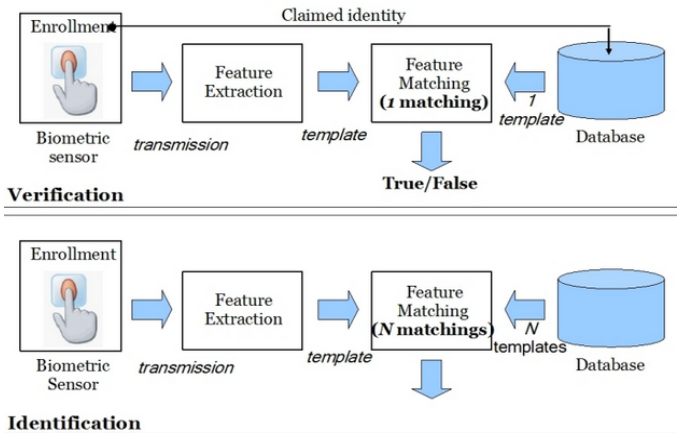

Figure 3: Verification Vs Identification

Fingerprint verification is to verify the authenticity of one person by his fingerprint. The identity card of the user contains the fingerprint along with the other information about the user. The verification system gets the fingerprint template according to the ID number and matches the template with the real-time acquired fingerprint. This is the underlying principle of AFAS (Automatic Fingerprint Authentication System).

6. GSM Modem

Global system for mobile communication (GSM) is a globally accepted standard for digital cellular communication. GSM is in 1982 to create a common European mobile telephone standard that would formulate specifications for a pan-European mobile cellular radio system operating at 900 MHz. GSM modem can be an external device or a PC Card . Typically, an GSM modem is connected externally to a computer through a serial cable or a USB cable. A GSM modem in the form of a PC Card / PCMCIA Card is designed for use with a computer systems. It is inserted to one of the PC Card / PCMCIA Card slots of a laptop computer. GSM modem requires a SIM card from a wireless carrier to function. AT commands is used to control modems by computers. A common set of standard AT commands is used by GSM modems and dial-up modems.

7. Simulation Results

7.1. Face Recognition

Face recognition is simulated using the MATLAB. First, the required input image is selected and its invisible features are extracted using the webers local descriptor algorithm. In WLD, each granules of face region is described by extracting its appearance and invisible features of an image. Next the Haar filter is applied to the image to detect the edge features of an image and to remove the unwanted noise present in the image. The resultant image produces is known as Webers face. Similarly the invisible features are extracted for the database image. Finally both the images are compared to find whether the person is authenticated or not. The snapshots for fingerprint verification are shown below:

Figure 4: Input Image

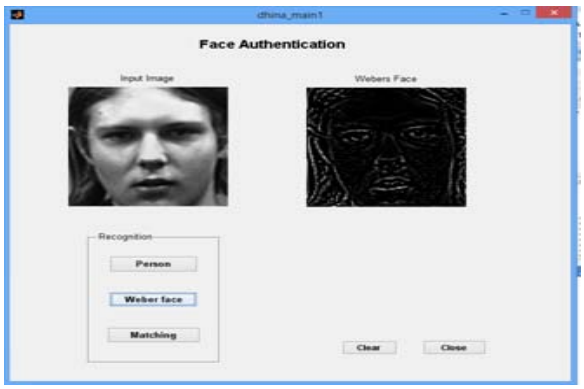

Figure 5: Weber's Face

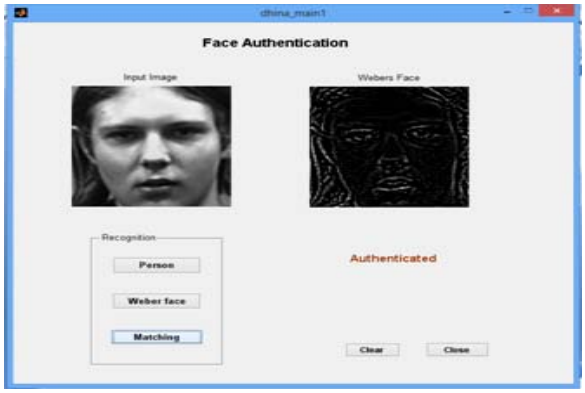

Figure 6: Matching

7.2. Fingerprint Verification

The input fingerprints are taken using the fingerprint scanner. Here, system takes two fingerprints images to be matched and gives the percentage score of matching between them. Based on the percentage score and the threshold value, it can distinguish whether the two fingerprint match or not The fingerprint verification is simulated in visual basic 6.0. Initially, the fingerprint image is captured using the fingerprint scanner and it is saved. In this way, various fingerprint templates can be created and saved. Once, the fingerprint image is ready for verification, it is verified for various inputs to display whether the person is authenticated or not. The snapshots for fingerprint verification are shown below:

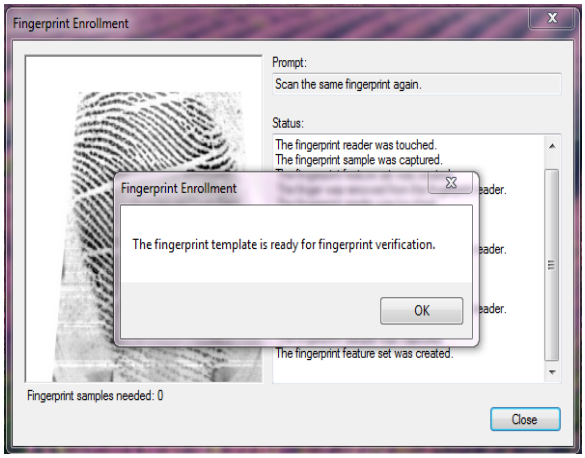

Figure 7: Fingerprint Enrollment

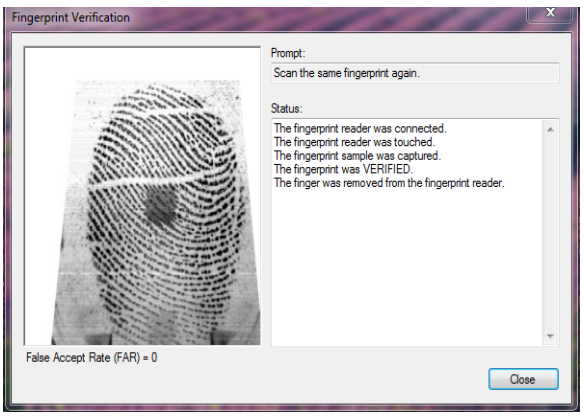

Figure 8: Fingerprint Verification

8. Conclusion and Future Work

A bimodal security system is implemented which includes the finger print and face recognition system in order to provide secure voting process. The GSM modem is also used to enable automatic counting of votes and it also makes the counting process faster. We are implementing the face recognition and fingerprint verification in the ARM7 microcontroller. The input image will be captured using the webcam and it will be verified automatically. LCD is interfaced to the output port of the microcontroller and it is used to show the information regarding the voting options available to the voters. GSM modem is interfaced to the microcontroller for the automatic counting of the votes. The software coding is dumped into the microcontroller using the keil c and the circuit is designed in ORCAD.

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