Face Recognition Application in ATM Security

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Abstract— In this paper the method of Face Recognition used to access Automated teller machines (ATMs). ATMs are used for banking function like checking balance; withdraw money, changing pin numbers, etc. The ATM cards and pin numbers are used for security purpose. But this system is using SIM card in place of ATM cards. In order to improve security the system first authenticate the person if he/she is recognized then it will ask the password of the account. This system used Spartan 3 FPGA board to control the system. One speaker is connected on the FPGA board which gives instructions to the user to access the account. If the person is not authenticated then the process is terminated and the output is show on FPGA board with the help of LEDs.

Keywords- Recognition, ATM, PCA, GSM, FPGA, Euclidian distance

I.　INTRODUCTION

The face recognition plays very important role in security system [4]. The main objective of face recognition is to recognize person from pictures or video using databases of face. There are lots of variation to design a face recognition is not an easy task [2]. Due to variation in illumination, facial expression and poses variations it is difficult to do face recognition [7]. A number of defense , security and commercial application demand real time face recognition system, especially when other biometric technique are not feasible [1]. In this paper the system is using face recognition to access the ATM. Automated teller machines (ATMs) are used by user to do banking function like withdraw money, checking balance etc. In these days ATMs are very popular because it works all days of the week and it provides 24 hours service. We can find ATMs anywhere in cities, railway stations, near societies, near restaurants, hotels, airports, Theaters, colleges, shopping malls and many other locations.[11].ATMs are convenient for users to make transaction or other banking function. It typically provides instructions on display screen of ATM that are read and listen by user to do all function of ATMs.
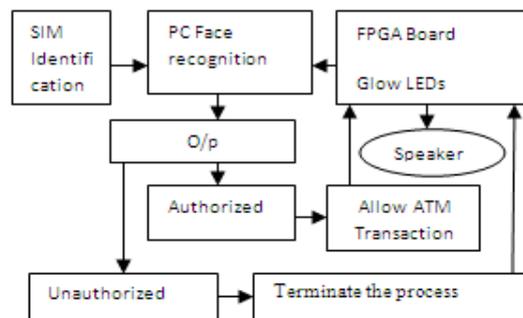

Fig.1 Block diagram of the System

User can operate the account after reading the instruction which and using the keyboard for entering information like pin number ect. But to access the ATM user should have ATM card always with when they want to access the bank, but in many cases user forget it.

This system designed the ATM machine which operates with SIM cards. This system designed the ATM machine which can be operating without the ATM card. By using this system ATM machine can access using mobile phone's SIM Card. When the SIM is inserted in the reader unit (GSM) of the ATM machine it transfers the data in the server. In the server information of the mobile number is collected i.e. account details, their name, account number, photo, etc. If details of SIM card matches, the device asks the face recognition. The recognition is done by MATLAB. When the image matches from the data base it asks for selecting the bank when the user select the bank it ask the pin number of bank account and next processing starts like user can make transactions, check balance etc, otherwise the process is cancelled. The system used Spartan-3 FPGA kit for controlling the system, one speaker is connected to the system on the FPGA board which guide the process for transaction. So by using this system there is no need to carry ATM cards. If the users image is not matches the system blocks the process of ATM and send signal to the FPGA board, the board glow the LEDs. By this system the security to access ATM is increased.

The machine is designed in Visual basic. VHDL is used for FPGA Spartan 3 board. Fig.1 shows the block diagram of the system.

II. RELATED WORK

Sajid I et al. presented a High performance FPGA based Face recognition system, where they used fixed point technique with software hardware co-design methodology which reduces cycle and provides the flexibility in face recognition [1]. Hau T. Ngo et al. described a flexible and efficient multilane architecture for real-time face recognition system based on modular Principal component Analysis method in an environment of FPGA, they showed that modular PCA improves the accuracy of face Recognition when face images have varying expression and illumination [2]. Sathaporn isakhasart presented new multipipelined architecture for face recognition system on FPGA. This architecture helps to reduce the recognition time through its pipeline process and also encourage the reduction in hardware resources [3]. Rala M. Ebied describe a method of feature Extraction using PCA and Kernel-PCA for Face Recognition in which they investigates the nonlinear kernel function to improvement the principal component analysis (PCA) for feature extraction. The experiments carried out to investigate the performance of Kernel-PCA by comparing it with the performance of the PCA. Two kernel functions are used with the kernel-PCA, polynomial and Gaussian functions, to check which one achieved a better performance. The k-nearest neighbor classifier with Euclidean distance is used to investigate the performance of the Kernel-PCA and PCA for classification step [6]. Kyungnam Kim presented Face Recognition using Principal Component Analysis study in which Eigen face used in recognition but this cannot useful in real time system[8]. Janarbek Matai et al. presented FPGA-based Real-Time Face Recognition System in which they design full face detection and recognition system on FPFA vertex 5. They used haar data for detection and Eigen face data for recognition from opencv. They found that the system can runs at 45 frames per second.

III. SIM IDENTIFICATION

The SIM identification is first process of our system. We used GSM modem for reading the SIM details. The GSM modem is connected with pc with serial port and with the use of Hyper Terminal we get the details of SIM. For digital cellular communication standards Global system for mobile communication (GSM) is globally accepted. GSM modem can be used as external device and it can connect to a computer through a USB cable or serial port. The GSM modem supports AT command and these commands are define in the GSM standards. The details of the SIM can be read by these extended AT commands. When the SIM is inserted in the reader unit (GSM) of the ATM machine it transfers the data to the server. In the server the information is collected related to the users like mobile number, SIM numbers, users account details, their photo etc. If the details of the SIM are matches then the image of the user is taken and then recognize with using MATLAB.

IV. FACE RECOGNITION

Face recognition systems play an important role in many applications like surveillance, biometrics and security [4]. It is a challenging task in terms of software ie developing algorithmic solutions and hardware ie creating physical implementations [4]. The face recognition system is a set of two tasks one is *Face Identification*: Means to take one image and compares with data base of the person and tell whose image it is and another is *Face Verification*: means to take one image face that is not in data base we need to verify that it is in the data base or not [11].
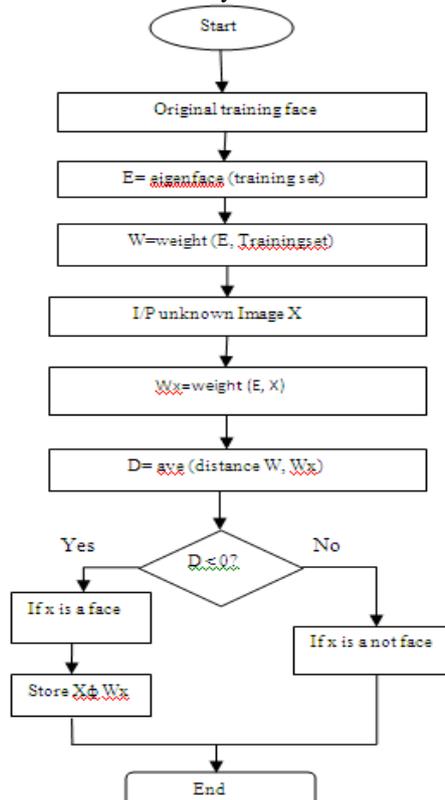

Fig. 2 Flow chart for PCA

For Face Recognition Principal Component analysis is very successful technique. It   helps to reduce the large dimensionality of the data space in to the smaller intrinsic dimensionality of feature space. This is the case when there is a strong correlation between observed variables [8]. Given an image or a sequence of images of a scene, identify or authenticate one or more people in the scene is not easy one because of under different illumination conditions, facial expressions, facial accessories, aging effects etc. We are using PCA algorithm for recognition. This is one of the most used and cited statistical method is the Principal Component Analysis (PCA).

It is a mathematical procedure that performs a dimensionality reduction by extracting the principal components. This principal component belongs from multi-dimensional data.

The principal component is the linear combination of the original dimensions that has the highest variability.

First we give one image in input, after that preprocessing is done. When the preprocessing is completed the next process is to extract the features, and then we calculate the value of Eigen value and Eigen vectors. And calculate the Euclidian distance of input image and database image. If the match is found the message comes that person is authorized and if the match is not found it display not authorized.

PCA performs dimensionality reduction by extracting the features, these feature are principal component. The first principal component is the linear combination of the original dimensions that has the highest variability.

- PCA is a statistical dimensionality reduction method
- PCA is used in application fields like face recognition and image compression
- PCA normally the use of Eigen faces
- Eigenvectors and Eigen values are used to represent face images ie Eigen Face.

After calculating the Euclidian distance the system recognizes the face and name of the person. If the Euclidian distance of input image matches then the person is authorized otherwise it is not authorized. The flow chart for pca is shown in Fig. 2.

V. ACCESS THE ATM MACHINE

Ones the person is recognized the system display the message that Person is authorized and the window of ATM machine is open. The machine ask for bank selection if we select the bank then it ask for pin number, after entering it the person can make their transactions related to banking like withdraw money, checking balance. The buzzer is connected on the FPGA board which guides to make transaction.

VI. FPGA DISPLAY

In this system Spartan 3 FPGA board for two purposes one is to guide ATM transaction with buzzer and to glow the LEDs if the system is not authenticate the person. System sends one signal to the LEDs on FPGA board. If the person is not in the data base the LED glows. If the system authenticates the person buzzer will on and give instruction to the user to make transaction.

VII. EXPERIMENTS AND RESULT

1) Face Recognition

The experimentation is carried out using PCA technique. The purpose of the experiment is to verify the person from the database and to know his or her identity. This system used database of persons and each person's ten images are available in database. In first row one to ten images are of Anant. Similarly in second row Shyam, in third row Arya and in fourth row Sarvesh. All four persons belong from database.

Fig.3 (a) Given Input Image

To verify and identify the person one image selected as input. The input image is shown in Fig. 3(a). After applying PCA technique the Euclidian distance of all images are calculated. The output shown in Fig. 3(b).

The result shows that person is authenticated and his name is Anant. Table I shows the Euclidian distance of images in which Image number 5 matches with the input image.

When the user is authenticated by face recognition, the form of machine is open to select the bank. This form is open only when the user is recognizing by the machine. The next process is selecting the bank, the user selected the bank. SBI bank is selected by the user. After selecting the bank it ask for pin number. The Figure 5.10 shows window of the entering the pin number.

Fig.3 (b) Output Authenticate person and his name

When the user enters the correct pin number the window of transaction is open. Where user can check his/her balance or can withdraw money. It is shown in Figure 3 (c)
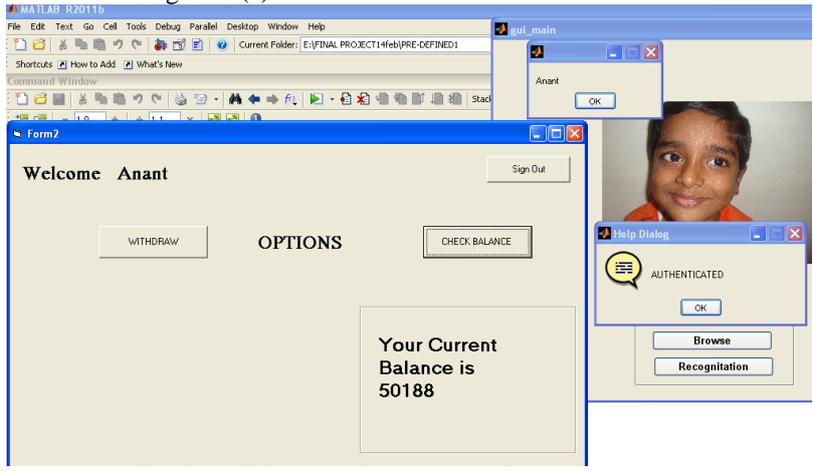

Fig. 3 (c) Window of transaction checking balance

TABLE I EUCLIDIAN DISTANCE OF AUTHENTICATE PERSON

I/p Image	Euclidian Distance	I/p Image	Euclidian Distance
1	0.0012	15	0.0013
2	0.0003	16	0.0001
3	0.0058	17	0.0002
4	0.0022	18	0.0001
5	0	19	0.0002
6	0.0002	20	0.0013
7	0.0002	21	0.0029
8	0.0015	22	0.0001
9	0.000	23	0.0001
10	0.0062	24	0.0001
11	0.0017	25	0.0001
12	0.0001	26	0.0002
13	0.0004	27	0.0002
14	0.0011	28	0.0002

In second experiment another input image is selected to verify and identify which is not belongs from data base. Fig. 4 (a) shows input image.

Fig. 4 (a) Given Input Image not belongs from data base

By use of PCA technique the Euclidian distance calculated. Fig. 4(b) shows the output result. It shows that the person is not authenticated. Table II shows the Euclidian distance of images in which no image matches with the input image.

Fig. 4 (b) Output Unauthenticated Person

TABLE II EUCLIDIAN DISTANCE OF UNAUTHENTICATED PERSON

I/P Image	Euclidian Distance	I/p Image	Euclidian Distance
1	0.0005	15	0.0005
2	0.0005	16	0.0009
3	0.0050	17	0.0009
4	0.0015	18	0.0007
5	0.0008	19	0.0010
6	0.0006	20	0.0021
7	0.0010	21	0.0007
8	0.0008	22	0.0009
9	0.0008	23	0.0009
10	0.0062	24	0.0009
11	0.0054	25	0.0010
12	0.0009	26	0.0010
13	0.0004	27	0.0010
14	0.0003	28	0.0010

2) ATM Access

When the system authenticates the person by face recognition the user can access the ATM machine. Now The user can make transaction like withdraw money ect. The ATM machine is designed in Visual Basic and the machine connected with FPGA via serial port. Speaker connected on the FPGA board which gives instruction to the user to operate the ATM. If the person is not authenticated the FPFG board glows LEDs. It shows that wrong person is trying to access your account. This system is more secure than others because its security level is high.

VIII.   CONCLUSION

In this paper the method of Face Recognition presented to improve the security of ATM. The face recognition done successfully. The Automated teller machine is designed which can access by SIM in the mobile phone. By this need of ATM card completely removed. And by face recognition security level of ATMs are increased. The transaction is more secure than before.

IX.   FUTURE WORK

This system is designed to make ATM transaction more secure. This time only database images were taken but in future real time system can be designed.

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