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Research Article

ATM TRANSACTION USING FACE-RECOGNITION SYSTEM BASED ON FPGA

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ABSTRACT

This paper presents an automated system for human face recognition in a real time background for ATM transaction. Now a days taking money from the ATM has become a major threat. When we are inserting our debit card the system is asking for the pin number. After typing the pin number the money that we need is been transacted. With the original debit card any one can take the money from the ATM. Now a days unknown strange people are creating a duplicate debit card and they use it in the ATM and loot our money. To eradicate this problem we are going for secured ATM transaction using face recognition. Now a days face recognition technique is playing a vital role in the field of secured process. By following this technique we can avoid the strangers looting our money and thus our money will be safer and secured. This process is carried out by matching the present captured face image to already stored database image. When both the images gets matched up ATM transaction is been allowed. If the images doesn't match up the transaction is been denied. But this task is very difficult as the real time background subtraction in an image is still a challenge. To detect real time human face, Principal Component Analysis (PCA) is used to recognize the faces detected with a high accuracy rate. Once recognition is done with the matched face, then the input image will be marked and updated in the database. This project gives much more solutions with accurate results in user interactive manner rather than existing normal transaction management systems. The ease of deployment is due to wireless mode of communication. A prototype of the controller is implemented, and shows how the controller can easily and flexibly control the appliances.

Keywords: Face recognition, RFID, PCA, Power Control, FPGA, RF Transmitter, RF Receiver, Image Compression, Encoder, Decoder.

INTRODUCTION

Person Recognition is one of the emerging research fields in computer vision. They are several biometrics used for Person Recognition like Iris, Fingerprints, Face etc. Since Iris and Fingerprints are very short-distance biometrics, but our application requires a person to be at a medium distance from the camera, which is fixed at the centre of each ATM machines, so that the view of the camera covers the entire room area¹.

As a worst case, our system should be able to recognize a person who is standing at the last, which might not be possible by using Iris or Fingerprints as a biometric. Hence we go for a medium range Biometric. Humans often use faces to recognize individuals and advancements in computing capability over the past few decades now enable similar recognitions automatically².

Early face recognition algorithms used simple image processing models, but the recognition process has now

enhanced into a science of sophisticated mathematical representations and matching steps. Many major improvements and technologies in the past ten to fifteen years have propelled face recognition technology into the spotlight. This system is developed in order to avoid the manual drudgery for entering the data daily while taking money and also to avoid time consumption³.

RELATED WORKS

Face recognition can be used for both verification and Identification (open-set and closed-set). There are two predominant approaches to the face recognition problem:

- Geometric (feature based)
- Photometric (view based).

The research going on for Face Detection and feature extraction are as discussed below:

A. Face Detection Methods:

The techniques used are as classified below:

- Knowledge Based Method
- Feature Invariant Method

- Template Matching Method
- Appearance Based Method

B. Face Feature Extraction Methods:

There are two main categories of face feature extraction techniques.

- Holistic Approach
- Feature-based Approach

In the holistic approach, the whole face is taken as input for recognition purpose. We can use PCA (Principal Component Analysis), for reducing the dimensionality of the data by projecting, it onto a lower dimensional subspace. We can go for LDA (Linear Discriminate Analysis), where the dimensionality reduction takes place such that the within ATM room variance is reduced. In Feature –based Approach, local features on face such as eyes and nose are detected and based upon which recognition is performed⁴.

Radio Frequency Identification (RFID) technology is used for the localization of the persons and persons in their environment.

HARDWARE SETUP

RFID tag and reader:

Radio frequency identification (RFID) technology relates to short-range wireless communications and uses the radio frequency to read certain information on a device known as a tag. They are commonly used for wireless data communication with R/W devices at distances ranging from a few millimeters to several meters.



Figure 1: RFID tag and reader

There are three fundamental RFID architectures in use today: passive, battery assisted passive (BAP), and active. Passive RFID tags do not carry their own energy source. They operate by harvesting energy from the reader and send data by reflecting energy back to the reader. Active RFID operates by utilizing energy from a battery or an equivalent local energy source. They send data to a reader by producing a low-power modulated signal. BAP RFID is a hybrid architecture that sends data by reflecting energy from the reader in the same manner as passive RFID, but utilizes a battery for its overall operation. In this system, RFID passive tags are deployed which are small and inexpensive that can be incorporated easily in an IC.

Most RFID tags contain integrated circuit (IC) chip, to store

and process data, and also an integrated antenna, which is used as the communication interface with read and write antenna system. When an RFID reader has to read data in the tag, radio waves from the reader are encountered by an RFID tag, the coiled antenna within the tag forms a magnetic field.

The tag draws power from it, energizing the circuits in the tag. The tag then retrieves and sends the information encoded in the tag’s memory. The majority of passive tags use EEPROM memory. Some are laser programmed at the silicon level. The tag functions without a battery and these have a useful life of twenty years or more⁵.

RF Transmitter:

RF transmitter TWS-434 is implemented in the system which is extremely small and suitable for shorter RF communication. The transmitter output is up to 8mW at 433.92 MHz with a range of approximately 400 foot outdoors and 200 foot indoors. The TWS-434 transmitter operates from 1.5 to 12 V DC and accepts both digital and linear inputs.

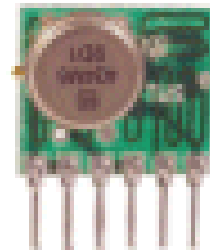


Figure 2: TWS-434

RF Receiver

RWS-434 is deployed as RF receiver in this system. As the transmitter, the receiver also operates at 433.92 MHz, to match the communication with that of the transmitter and has a sensitivity of 3µV. The RWS-434 receiver has both linear and digital outputs and operates from 4.5 to 5.5 V DC.



Figure 3: RWS-434

FPGA:

The main advantage of this system is the implementation of Field Programmable Gate Array commonly known as FPGA. Spartan 3A series FPGA is used in this project. The FPGA design flow involves design entry, synthesis, simulation, implementation and programming. The main advantage of using FPGA is that the program can be modified and updated or altered at any point of time⁶.

Some of the important features of Xilinx Spartan-3A are it is high-performance logic solution, very low cost for high-volume, cost-sensible applications. It simplifies 3.3V-only design by providing dual-range VCC AUX supply. Effective use of system power is done as suspend and hibernate modes are available.

When system is idle it will enter into any one of the above said mode according to the program. Multi-standard select IO interface pins and Multi-voltage are provided in this series. Abundant, flexible logic resources, up to eight Digital Clock Managers (DCMs) makes this suitable to our system.

Hierarchical Select RAM memory architecture, eight low-skew global clock networks, eight additional clocks per half device, plus abundant low-skew routing and configurable interface to industry-standard PROM are the added features of this series.

TEST SETUP

As researcher interest in face recognition, many distinct algorithms were introduced in which Principle Component Analysis (PCA) is used here. The system proposed a real time design which takes image as an input through a web camera continuously. When we show the RFID tag the camera takes the image and it compares with the already stored image and then only it will allow for the ATM transaction if the images matches up.

It is a way of identifying different conditions of images marking. The camera should be installed in a place with good light in the background and free of obstacles. The Principal Component Analysis (PCA) is one of the most successful techniques that have been used in image recognition and image compression. Under the broad title of factor analysis, PCA is one of the suitable statistical methods. In case of strong correlation between observed variables, PCA is used to reduce the large dimensionality of the data Space (observed variables) to the smaller intrinsic dimensionality of feature space (independent Variables). It is also needed to describe the data economically.

Redundancy removal, feature extraction, prediction and data compression, etc. can be done by PCA. Because PCA is a classical technique which can do something in the linear models such as image processing, signal processing system and control theory.

Face recognition is applicable to many functional areas. Moreover, it can be categorized into face identification, face classification, or gender determination. The most useful applications contain video content indexing, crowd monitoring, personal identity (ex. driver's licence), mug shots matching, entrance security, etc. PCA for face recognition which is also called Eigen space projection is to express the large 1-D vector of pixels constructed from 2-D facial image into the compact principal components of the feature space. Eigen space is determined by identifying the eigenvectors of the covariance matrix derived from a set of facial images (vectors).

Step 1: The card owner face image is already been stored in the banks database.

Step 2: The owner will go to the ATM and shows his RFID tag in the ATM machine.

Step 3: The machine will read the tag and the camera located in front of the person captures the new face image of him.

Step 4: Now the new input image is been carried from the RF Transmitter to the RF receiver and the two images are matched up.

Step 5: If the two images matches up with each other the transaction takes place. If the two images doesn't match with each other transaction is been denied.

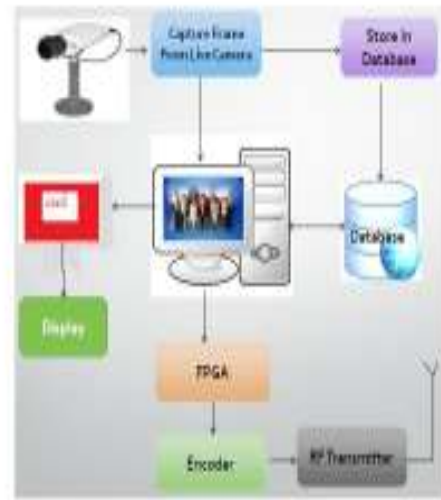


Figure 4: Block Diagram of ATM management in Transmitter section.

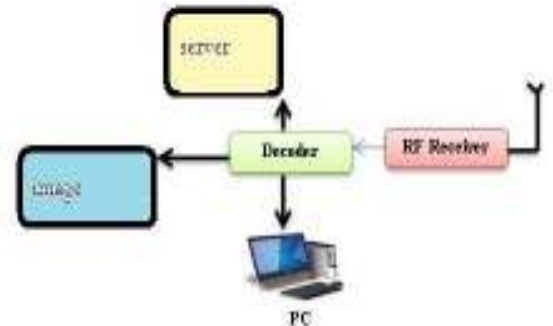


Figure 5: Block diagram of receiver section.

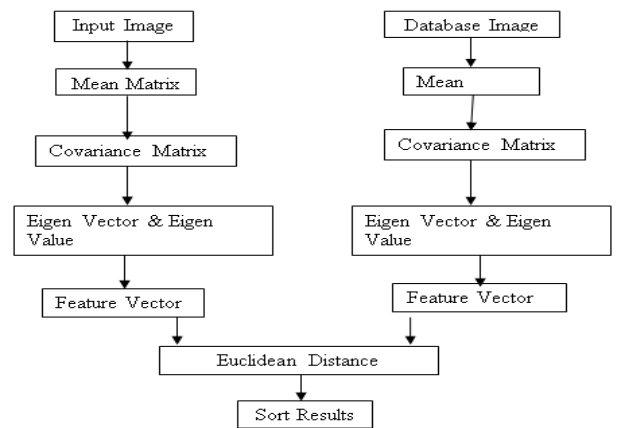


Figure 6: Working principle of face recognition method

CONCLUSION

Due to the threat in ATM transaction management system, Person Recognition technique have gained a lot of importance these days. Hence, depending upon the size of the Training Database, recognition rate varies for both of these algorithms. And also we have observed that the recognition rate achieved for real time is much lesser when compared to offline images. With the help of face recognition technique now ATM transaction is well secured and our money will be safer for ever. Hence by this method only the authorized person can alone take the money, strangers or unknown persons cannot access it. In future the same can be enhanced with 3D camera and motion capturing technologies for achieving best results.

REFERENCES

1. Turk M, Pentland A, Eigen faces for Recognition, Journal of Cognitive Neuroscience, 1991; 3(1): 71-86.
2. Lu J, Plataniotis KN, Venetsanopoulos AN, Face Recognition Using LDA-Based Algorithms, IEEE Trans. On Neural Networks, January 2003; 14(1): 195-200.
3. Ramesha K and Raja, Feature extraction based face recognition, gender and age classification, (IJCSSE) International Journal on Computer Science and Engineering, 2010; 2(1S): 14-23.
4. Ekenel HK, Stallkamp J, Gao H, Fischer M, Stiefelhagen R, Face Recognition For Smart Interactions, interact Research, Computer Science Department, University at Karlsruhe.
5. Kyungnam Kim, Face Recognition using Principle Component Analysis, Department of Computer Science, University of Maryland, College Park, MD 20742, USA.
6. The Code Project, EMGU Multiple Face Recognition using PCA and Parallel Optimisation, 05 October 2011.

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