International Journal of Information, Control and Computer Sciences
ISSN: 2517-9942
Vol:7, No:12, 2013

Design and Implementation of an Image Based System to Enhance the Security of ATM

Seyed Nima Tayarani Bathaie

***Abstract*—**In this paper, an image-receiving system was designed and implemented through optimization of object detection algorithms using Haar features. This optimized algorithm served as face and eye detection separately. Then, cascading them led to a clear image of the user. Utilization of this feature brought about higher security by preventing fraud. This attribute results from the fact that services will be given to the user on condition that a clear image of his face has already been captured which would exclude the inappropriate person. In order to expedite processing and eliminating unnecessary ones, the input image was compressed, a motion detection function was included in the program, and detection window size was confined.

***Keywords*—**Face detection algorithm, Haar features, Security of ATM.

I. Introduction

CONSIDERATION of the increase in the use of ATMs, problem of their security and degree of certainty have become very consequential. Regarding these systems, because no identity verification is performed other than an ATM-card with four-digit password, fraud and crimes could be committed simply by obtaining one's password and ATM-card. Although there is a camera embedded in some of the ATMs, it is barely enough to prevent fraud because the wicked person often hides his face while defrauding. Therefore, if this security system improves in a way that necessitates the presence of the owner of account as well, the number of fraud through ATMs could noticeably decline.

To identify a person, various biometric technologies could be used including finger print conformity, 3-dimensional scanning of face, examination of the person's voice and video chat [1].

Face detection could be carried out through a biometric system, in which a person's identity is detected or verified based on physiologic characteristics [2]. In this case, different approaches have been employed, in each of which, many algorithms in image processing have been designed. In the case of biometry, the use of face is widely made. Elastic Bunch Graph Matching (EGBM) algorithms are used as a method for face detection, in which geometrical condition of the face and the location of the important points on it is utilized [3]. In another study, physical properties of the face and the correlation between them are investigated [4]. Crease and wrinkles on the exterior structure of the face, which is, similar to fingerprint, different from one person to another, are also examined [5]. In Facial thermogram, using of infrared camera, an image of the face surface is attained in which, different points of the face are specified through their different temperature and heat. Because degree of accumulation of the vessels under the face skin is diverse in individuals, the map taken from them is also different [6].

System and approach of face detection for prevention of crime committing was first registered as a patent in the United States [7] that one of whose use is in the ATMs. In this method, if inappropriate person cover his face with mask, or wear a sunglasses, would not be able to receive money from the ATM. The owner of the account is given a chance to take off his glasses and try once again, but the inappropriate person is unwilling to do the same thing leading to prevention of the crime.

The aim of this research is to design and implement an image receiving system with the capacity of the face detection for using in the ATMs. To do this, face detection algorithms in method of Haar features cascading are combined and optimized resulting in a novel algorithm for face detection with focus on eyes.

II. Material And Method

A. Material

In this work, face detection algorithms in method of Haar features cascading are combined and optimized.

In order to record a clear image on the computer, different tools and software were used consisting of VC0305 camera (ViMicro), micro 2440 friendly arm board (Samsung), Ethernet cable (UTP, cat 5), laptop and a software developed by the author for checking results.

B. Method

After the ATM-cart insertion, system starts taking photo of the user. The taken photo is investigated to found user's face. As the user's face is identified, a welcome screen will be shown on the screen to the user and he is permitted to continue; otherwise, the process continues until the face is identified or time limit passes.

III. Discussion

Face recognition is a computerized technology, whose aim is to determine the position and dimension of the people's figures in the digital images. This technology specifies the human's face and exclude such other things as buildings, trees and so on. Viola and Jones [8] suggested an algorithm in which the face is detected rapidly in an image. In this method, Haar-like properties of the digital images are used to detect a face in a picture. The name of Haaris attributed to them due to

Seyed Nima Tayarani Bathaie is with the Department of Computer Engineering, Amirkabir University of Technology, Tehran, Iran (e-mail: nima.bte@ gmail.com).

the similarity to the Haar wave.

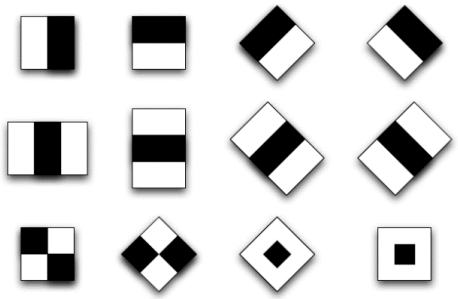

Fig. 1 Basic types of Haar features

Face detection in an image is possible as long as face could be specified separately from the background. In the whole face area, the eyes are darker than the cheeks. Therefore, one of the common Haar properties for face detection is a set of two neighborhood rectangles lying above the eyes and cheeks. The rectangle in which the search for face is performed using these Haar features, is regarded as detection window.

Viola and Jones used a method in machine learning called Ada Boost [9] to choose a specific Haar property. In this approach, in order to attain a strong classifier, numerous weak classifiers are joined together. Viola and Jones combined a set of strong classifier in the form of a filter chain. Each filter is a separate strong classifier itself, consisting of a few weak classifiers. If any of these filters fails in accepting an area of an image as a face, the area is classified as a no-face area. When a filter accepts an area of the image as a face, this area is entered the next filter of the chain (Fig. 2). If the area of image passes successfully through the whole filters of chain, the area is classified as a face.

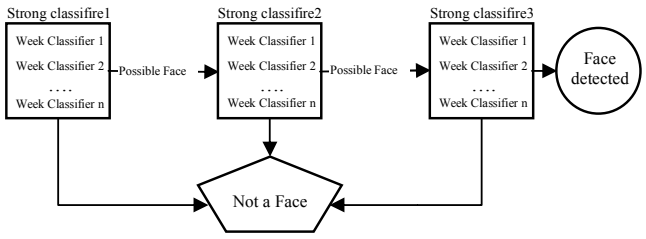

Fig. 2 Cascade of three strong classifiers

In this work the face detection algorithms separately were used for face and eye detection, and results are connected together in the form of a novel cascade algorithm (Fig. 3). The program applies this algorithm on several detection windows covering all over the received image in different sizes and if no face is detected the program will print an error sign on the screen, declaring lack of face on the received image, sending request for another picture. If one detection window passes successfully both chains of filters, this area can be classified as a face [10].

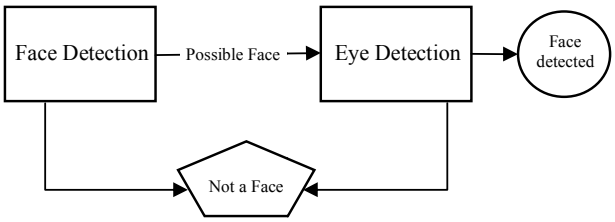

Fig. 3 Cascade of Haar feature based eye detection and face detection algorithms

In order to increase the speed also preventing from extra processing, constraints on dimension are applied onto the detection windows. In fact, the program does not process detection windows smaller than a specified size. It results in discarding the images which might erroneously be accepted as face-contained whereas the area in front of the camera is crowded.

For implementation of the algorithm, first Linux system was installed on the arm board. For detection of camera by board when connecting them together, available drivers in Libv4l library were used. For compressing the received image from camera, lossy JPEG algorithm was used; this algorithm is applied when all the data are not necessary, or just some of pieces are important, and is widely designed for elimination of specifications which are not readily detectable by human eyes [11]. In order to encrypt the compressed image TDEA algorithm [12] was used; this algorithm is a member of symmetric-key algorithms in which DES algorithm is applied three times on each block. Next step consists of the transmission of the encrypted image, from board to computer which is performed using Ethernet cable. After decrypting the image in the computer, the processing of image for determination of whether the image contains a face or not is carried out.

One purpose of this work is to take a clear and not blurred image of user. Therefore, Motion detection is performed on the board. It prevents the transmission of blurred images to computer, in the manner that after each request from computer for image, program on the board captures two consequent pictures with a little interval. Motion detection is done through comparison of the size of these two images. If their difference is lower than a pre-defined threshold, the second image is considered clear and transmitted to the computer. The whole steps of the face detection and giving the permission of the bank proceeding in an ATM system, is illustrated in Figs. 4 and 5.

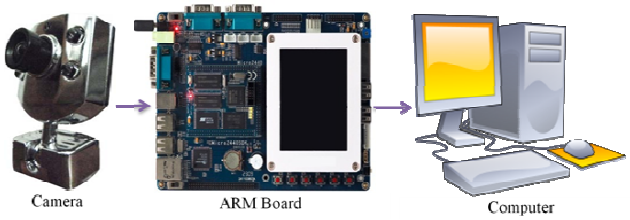

Fig. 4 The order of data transmitting in the designed system

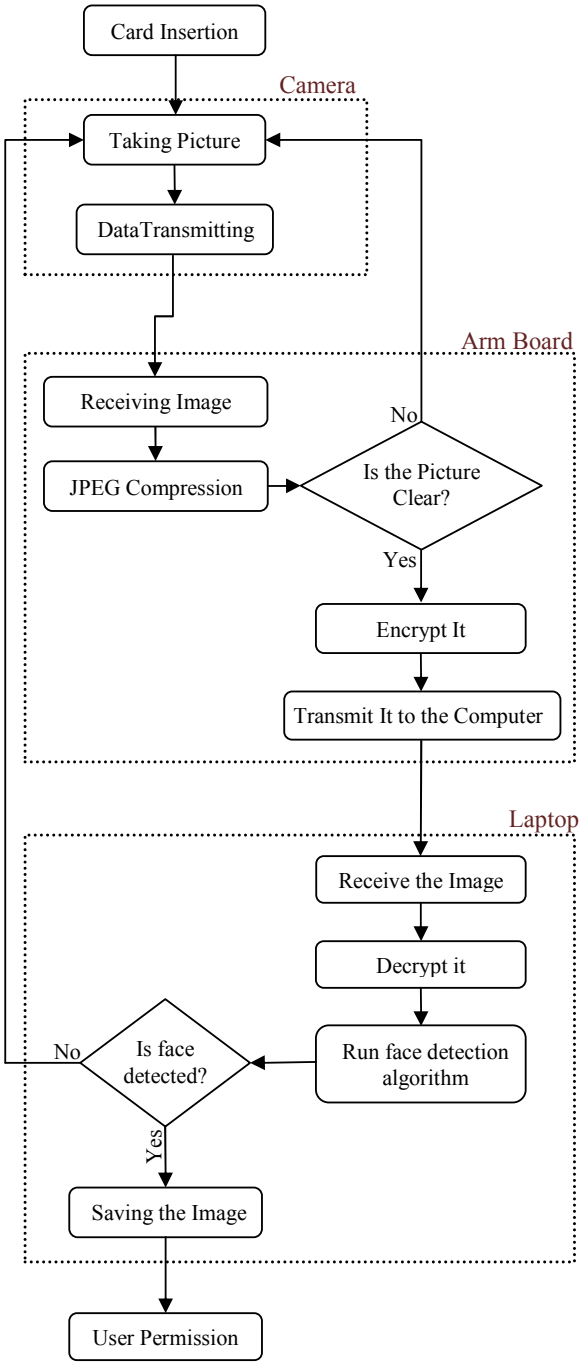

Fig. 5 System block diagram

IV. Conclusion

Object detection algorithms, in which, Haar features are used for detection of face and eyes was separately implemented and used for receiving a clear and detectable image of the person standing in front of the camera. Services in ATMs are available as long as the clear image of the user is taken, which the inappropriate user is unwilling to be taken of. Therefore, this method is an economical way to improve the security of the ATMs, which would prevent crime.

Input image compression, declining the image size, reduced the overall processing. On the other hand, less image size enables the system to save more pictures of users in a specific memory.

Consideration of limitation on the detecting window size and adding the capability of motion detection to the program, with prevention of the extra processing, increased the speed.

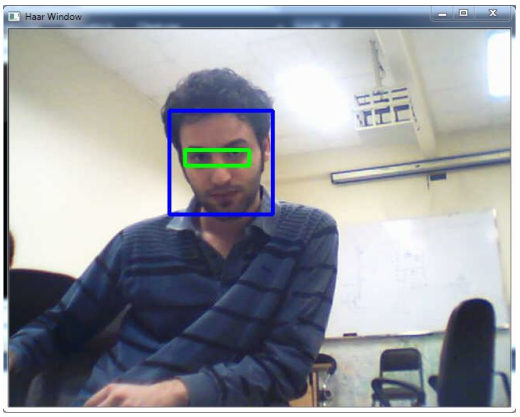

Fig. 6 Application of a regular user

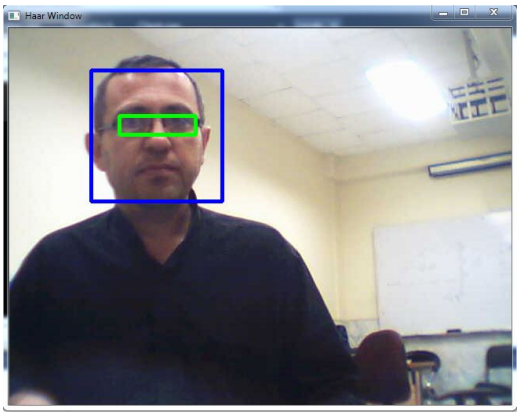

Fig. 7 Application of a user wearing glasses

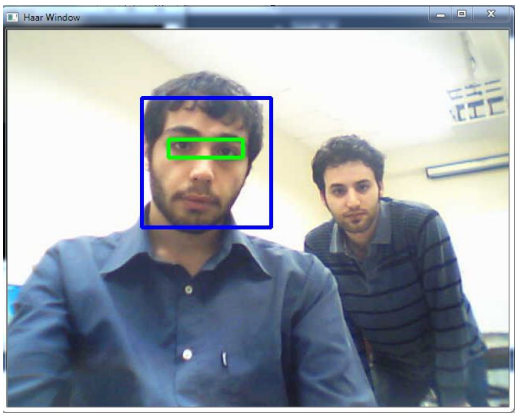

Fig. 8 Application when more than one are in front of the camera (The person's face who is within the specified range is detected)

REFERENCES

[1] S. Sruthy. "Literature Survey on Automated Person Identification Techniques." (2013).
[2] M. T. Harandi, M. Nili Ahmadabadi, and B. N. Araabi. "Optimal local basis: A reinforcement learning approach for face recognition." International Journal of Computer Vision 81, no. 2 (2009): 191-204.
[3] M. Sharif, A. Khalid, M. Raza, and S. Moshin. "Face Recognition using Gabor Filters." Journal of Applied Computer Science 5 (2011).
[4] H, Lee, C. Wu, and T. Lin. "Facial Expression Recognition Using Image Processing Techniques and Neural Networks." In Advances in Intelligent Systems and Applications-Volume 2, pp. 259-267. Springer Berlin Heidelberg, 2013.
[5] J. S. Leibold, A. Riehl, J. Hettinger, M.Durben, J. Hess, and P. Angel. "Keratinocyte-Specific Deletion of the Receptor RAGE Modulates the Kinetics of Skin Inflammation In Vivo." Journal of Investigative Dermatology (2013).
[6] G. A. Papakostas, V. G. Kaburlasos, and T.Pachidis. "Thermal infrared face recognition based on lattice computing (LC) techniques." In Fuzzy Systems (FUZZ), 2013 IEEE International Conference on, pp. 1-6. IEEE, 2013.
[7] J. Chang. "Facial surveillance system and method." U.S. Patent Application 10/429,720, filed May 6, 2003.
[8] P. Viola and M. J. Jones. "Robust real-time face detection." International journal of computer vision 57, no. 2 (2004): 137-154.
[9] Y, Freund, and Robert E. Schapire. "A desicion-theoretic generalization of on-line learning and an application to boosting." In Computational learning theory, pp. 23-37. Springer Berlin Heidelberg, 1995.
[10] S. N. Tayarani Bathaie, "Design and implementation of an image receiving system with the ability of face detection to be served in ATM system", Msc Thesis, Department of Internet Technology and computer engineering, Amirkabir University of Technology, 90 pages.
[11] W. B. Pennebaker. JPEG: Still image data compression standard. Springer, 1992, pp. 78_79.
[12] Http://en.wikipedia.org/wiki/Triple_Dess.