



A Review: Design and Implementation of Image Acquisition and Voice Based Security System

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ABSTRACT: This paper gives a brief overview of security using Biometrics Parameters. Security is one of the utmost requirements of homes and businesses which require multimodal biometric identification. This paper aims to identify a person through Voice and face recognition. The ARM based voice recognition module is used for voice recognition. Also some other techniques available for voice recognition are spectrum analysis using Matlab or readily available voice recognition module interfaced with ARM. The Purpose of using ARM is its high processing capacity, small size and low power consumption. A second level biometric identification is face recognition. A Matlab based Principal Component Analysis (PCA) and Adaboost Algorithm is used for face recognition. If both voice and face will be recognised then access will be granted to a particular person.

KEYWORDS: Face detection; Matlab; ARM; Voice Recognition; Principal Component Analysis (PCA); Adaboost Algorithm.

I.INTRODUCTION

Most of the systems that control access to financial transactions, wired or wireless computer networks and secured locations identify authorized persons by recognizing passwords or personal identification numbers (PIN). The weakness of these systems is unauthorized persons can discover others passwords and numbers quite easily and use them without detection. The Biometric identification systems, uses physical features to check a person's identity, having much greater security than password and number system. Biometric features such as the face or fingerprint can be stored on a microchip in a credit card. For example, If someone steals the card and tries to use it, the impostor's biometric features will not match the features stored in the card and the system will prevent the transaction. A single feature, however, sometimes fails to be exact enough for identification. When considered identical twins, e.g. their faces alone may not distinguish them. Another disadvantage of using only one feature is that the chosen feature is not always readable. Therefore, we need to develop Biometrical Identification (BioID), system that uses two different features face and voice to identify people. With its two modalities, BioID achieves much greater accuracy than single feature systems. Even if one modality is occurring an errors; for example, if a noisy environment drowns out the unwanted voice the other facial image still lead to an accurate identification. A voice password system can be used for access security using speaker verification technology has been designed for use over dial-up telephone lines. The voice password system can provide secure access to telephone networks, rooms, computers and residential or commercial buildings. This also has application in office automation systems, electronic funds transfer and "smart cards" (interactive computers embedded in small and moderate sized packages). Now days it is need that attention is focused on access security in the public, private, and government sectors, the voice password system can provide a timely solution to the security problem. Voice recognition can help users to be focused on their current work without extra effort for hands or eyes, and without extra learning time. Voice based applications has the ability to interact with a user by voice commands.

A natural way to identify a person is through their voice and face. Propose to implement a new portable face and voice recognition system based on the Matlab and ARM processor for security purposes. The motive behind using ARM is its high processing capacity, small size and low power consumption. To make the system more effective the proposed work will aim at implementing 2 stages or levels of security. First the user will pronounce the predefined password through the MIC on the ARM board. Secondly an USB camera installed at the door will be used to capture the facial



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image. This image will be processed with the help of Matlab and Principal Component Analysis compared with the existing database. If the match is found then the identification of the person is confirmed.

II. RELATED WORK

Face detection is the class of problem where difficult to decide if there is a face or not in the picture. Many face detection methods are same as face recognition Algorithms; or other way methods used in face detection are also used in face recognition; some methods are explained as follows.

- A. **Knowledge-based methods:** Ruled based Methods in this knowledge of human faces are encoded. This is feature non variant method. This method is used by the human brain; difficulty in this method is translation of human knowledge to well-defined rules. If the rules are so strict then they may fail to detect faces or may not pass the rules. If the rules are too general then may be false detections
- B. **Template Matching Methods:** In this Algorithms Templates for input facial images (training images) is compared with database facial image templates or features. This method can be applied on various changes or variations in the facial images such as pose, scale and shape. Sub-templates, Multi-scales and Multi resolutions are also used for frontal face detection. Face edge is extracted using Sobel filter.
- C. **Appearance-based methods:** It is the extension of the pattern matching method in which patterns of database images is compared with input image.
- D. **Face detection in Computer Vision Area:** There are two steps in this face detection and face localization.
 - **Face Detection:** In this step from the arbitrary image determine whether face is present or not in the given image if present then extract the required features from each image.
 - **Face Localization:** This step determines unique features of the face eg. Facial colour, beared, eye colour, mustache, distance between eyes etc. The performance of human vision system is so high. Therefore, he can detect not only a single face but multiple faces at the same time having different pose, facial expression, scales, orientation and lighting conditions; even the faces do not have complete. Partial view of humans is enough to detect them in images. Unfortunately today's computer vision system can't achieve that performance.

Image Acquisition using portable infrared camera they design embedded image acquisition system using ARM and TVP5150 decoder. Design is based on a processor of S3C6410 and Windows 6.0 Operating System and for the Hardware platform particular driver is designed; results image captured has good quality [1]. Wang Jisen et. all have proposed a video capturing and processing technology; In this embedded microprocessor chip S3C3410 of ARM9, Linux Operating System and Hardware Software Co-design approach used. This system is compact and operates without PC intervention so configuration is flexible and more friendly display interface. Yong lin Liu et. all have used same approach for image acquisition [2],[3]. Richard M. Jiang et. all have proposed a novel video based multimodal biometric verification scheme for this they uses subspace based low level feature fusion of face and speech for specific speaker recognition or human computer interaction; In this human face is tracked, pose estimated to weight facelike regions in successive frames and ill posed faces and false positive detection are assigned with lower credit to enhance accuracy. In Audio recognition, frequency cepstral coefficients (Frequency Spectral) are taken or extracted for voice verification; In this Adaboost Algorithm And Matlab is used [4]. B. Koteswar rao et. all have proposed face recognition system using LPC ARM 2148 and Windows operating system. The face is detected using HAAR features and recognising by LBP features. Matlab is used in the front end and Keil code is used in the backend [6]. T.D. Prashanti, Mamta Kalas et. all have proposed face detection and tracking using OpenCV library. Human face localisation and detection is important step in Application like video surveillance and human computer interaction. Haarlike features and Adaboost these two Algorithms also used in the Open source Computer Vision (OpenCV) library [5],[8]. Voice can be powerful tool for the human communication and human computer interaction. Voice recognition can help users to be focused on their current



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work without extra efforts of eyes, hands or extra learning time. Kwang B. Lee has explained so many user interfaces for voice Applications in mobiles [7]. Taranpreet Singh Ruprah have proposed the face recognition method using PCA and neural network back error propagation Algorithm ; In this features are extracted using PCA and classification using back error propagation Histogram Equalization and Euclidean distance is also used for this comparison [9]. The PCA using Neural Network also proposed by Mohan A. R. et. all but Hardware used A VLSI Array Architecture and its FPGA implementation [10]. Shlomo Engelberg et. all have proposed Voice identification through Spectral Analysis a Matlab based computer program is used for the voice recognition [11]. Renald Buttermore et. all have proposed the further developments in voice recognition technology they used different software models like Acoustic mode and developed voice recognition technology [14]. Jufen Qian et. all have proposed improved method of face detection and recognition based on information of skin colour and depth information obtained by Binocular vision system. In this face area was detected by Adaboost Algorithm then the real face was distinguished from fake one by using skin colour information and depth data. Then by using PCA Algorithm a specific face can be recognised by comparing the principal components of the current face to facial database [12]. The same method can be Applicable for the human detection for CCTV Recording Application which is explained by Rami Badaoui and Adel Al. Jumaily [13]. PCA was invented in 1901 by Karl Pearson. PCA is variable reduction procedure and useful when obtained data have some redundancy. This will result into reduction of variable into smaller no. of variables which are called Principal Component. The major advantage of PCA is using it in Eigenfaces approach which helps in reducing the size of the database for recognition of a test image. The images are stored as their feature vectors in the database which are found out projecting each and every trained image to the set of Eigenfaces obtained. PCA is applied on Eigenfaces approach to reduce the dimensionality of a large data set [10].

III. PROPOSED METHODOLOGY

The proposed Voice and face recognition system overcomes the limitations of the existing security systems. The existing system cannot tolerate variations in the new face image it needs the new image to be almost exactly same as one of the image in the database. The performance level of existing systems is not appreciable. The Proposed work aims to develop highly secure face and voice recognition system. It will be optimised for use in home, business and industrial Security. Military Security Applications will be considered as a future scope. Block diagram of proposed system is shown in Fig. 1.

The System Operation Starts with user pronounce a voice password through MIC. The Voice Recognition Module is interfaced with the ARM7 Board. If voice password is recognised by the system then next step goes to the face detection. Using an USB Camera Interface Image is captured and stored in the database. When the next time the same person is coming again the image is captured and Compared with the previous database if the match is found then the permission is granted. Handling of captured image is done using Image Acquisition Toolbox Available in the Matlab. The Graphical User Interface Available in the Matlab which helps more for handling Facial Image.

Comparison of Facial Image is done using Adaboost and PCA (Principal Component Analysis) Adaboost Algorithm used for face detection using skin colour information and PCA is used for the comparison purpose. Finally if current image is matched with any of existing images in the system database means the system recognizes the user face it displays the user ID and Buzzer Beeps.

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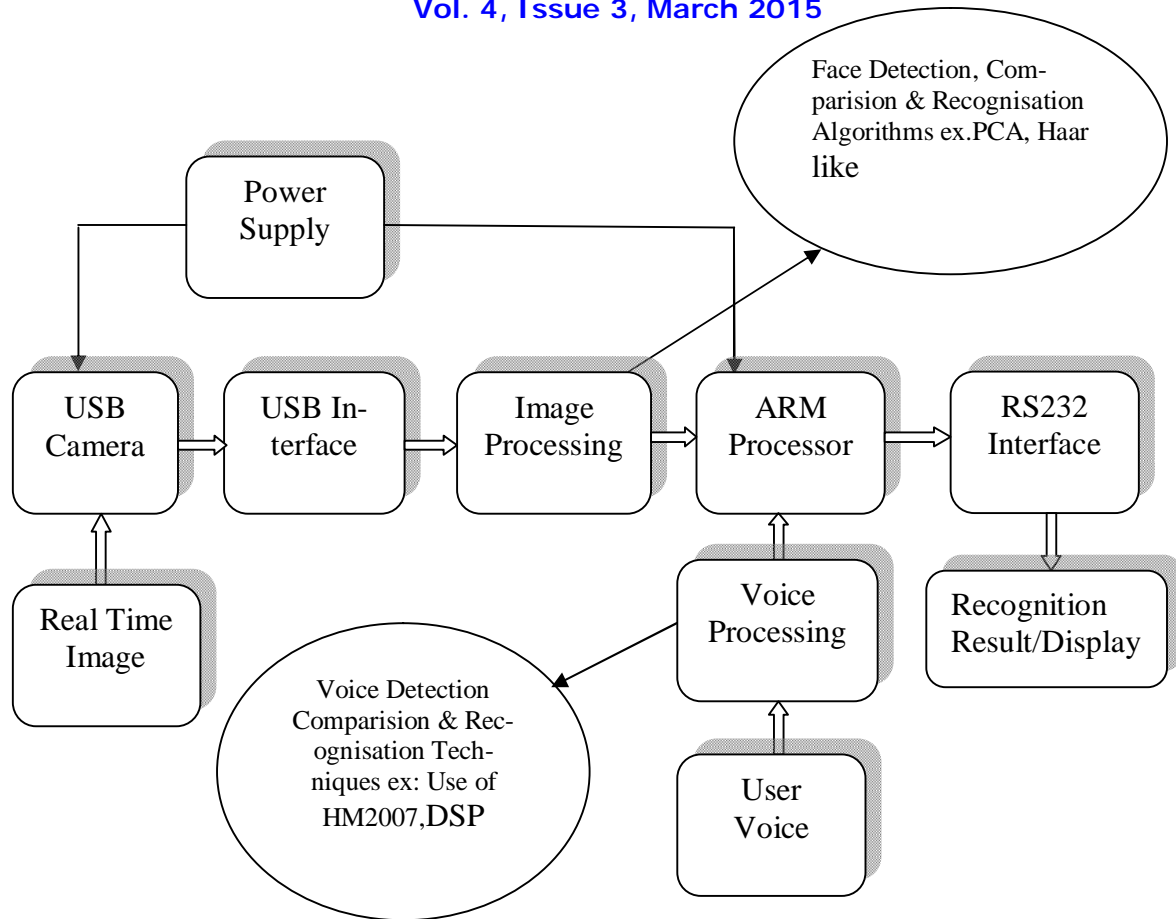


Fig.1 Block Diagram

The detailed description of each section Fig. 1 Block Diagram of Image Acquisition and Voice based Security System is shown below.

- **Real Time Image**

The facial image which covers the frontal face area which should be enrolled by the user and recognised by the system. This image has no. of characteristics such as colour RGB or Gray Scale, Resolution of image, Height and Width which can be used for Face recognition.

- **Digital USB Camera/ Webcam**

Encodes digital images and videos digitally and stores them. Digital Cameras shares an optical system, using a lens with a variable diaphragm to capture images. Using Matlab image acquisition toolbox some command like 'winvideo' it is possible to retrieve camera details and set the resolution of captured image which can be used for face recognition.

- **USB Interface**

USB is designed to allow many peripherals to be connected using a single standardized interface. It provides an expandable, fast, bidirectional, low cost plug and play serial hardware interface so the computer can access Video Cameras for facial image acquisition.



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- **Image Processing**

This is the most important step in which using Matlab image acquisition toolbox (Capture image and Store in Database) face detection, normalization, feature extraction and comparison with existing database stored in the available memory. For face detection and recognition uses the Adaboost and PCA Algorithm for comparison the haar-like classifier algorithm can be used.

- **User Voice/ Password**

Every User has predefined word to pronounce in front of mic interfaced to ARM7 board the production of sound originates at the vocal cords. In between vocal cords there is a gap when person attempt to communicate, the muscles controls the vocal cord contact. The gap narrows; breathe passes through the gap which creates sound. The Unique pattern of an individual voice is produced by the vocal tract.

- **Voice Processing**

In this Scheme Voice Password Spectrals are stored in the database of voice recognition module. Using Interfacing of ARM 7 and voice recognition module pronounced voice spectral can be compared with existing database; Using Sound dynamics and the Template matching method can be used to recognise voice commands. Some voice recognition modules like HM2007 are also available which can be interfaced with ARM 7 and Recognise Voice.

- **ARM7 Processor (LPC2148)**

Processor is used for voice processing and collect result of face recognition combining these two results declare the final Result.

IV.CONCLUSION

A complete security for safeguarding to business offices, houses and banks are necessary due to the increase of thefts; as the security increases the cost of the security increases hence it is important that offices be secure and also security systems used should be cost effective.

The natural way to identify the person is through their voice and face and this system designed with the combination of embedded and Matlab by using this possible to provide complete security.

Face recognition is done using Adaptive boosting and Principal component Analysis which reduces the face features components for comparison called eigen values due to this the computation time and space required for calculation and comparison of eigen faces is reduced and system will work more faster.

Security system using Matlab (Adaboost and PCA algorithm) and Embedded system provide cost effective, reliable and highly accurate response.

REFERENCES

- [1] Liu Jianzhuo, Bai Jing, Zhao Jian, Sun Qiang, Bi Guoling, "Portable Infrared Camera Based On Wince And Arm", IEEE Xith International Conference on Electronic Measurement And Instruments, pp.179-182, 2013.
- [2] Wang Jisen, Zhao Hubin, "The Design of Image Acquisition System Based On Arm", IEEE Xith International Journal of Northwestern Polytechnical University China, pp. 384-386, 2011.
- [3] Yonglin Liu, Ying Liang, Yaoyu Cheng Senior, "Design And Implementation Of Image Acquisition System Based On Arm And Linux", Ieee International Conference On Electronics And Optoelectronics, pp. V349-V352, 2011.
- [4] Richard M. Jiang, Abdul H. Sadka, Danny Crookes, "Multimodal Biometric Human Recognition For Perceptual Human Computer Interaction, " IEEE Transactions On Systems, Man And Cybernetics, Vol. 40, No.6, Nov. 2010.
- [5] T. D. Prashanthi, K. Rajshekhar And T. V. Janardhana Rao, "Design Of Arm Based Face Recognition System Using Opencv Library", In Proc. International Journal Of Advanced Research In Computer Engineering And Technology, Vol. 1, No.9, pp.233-240, Nov. 2012.
- [6] B. Koteswar Rao, P. Rama Krishna And M.A. Wajeed, "Real Time Embedded Face Recognition Using Arm7", In Proc. International Journal Of Research And Communication Technology, Vol. 2, No.5, pp.274-278, May 2013.
- [7] Kwang B. Lee And Roger A. Grice, " The Design And Development Of User Interfaces For Voice Applications In Mobile Devices, " In Proc. International Research Of Mobile Telecommunication And Network, pp.308-320, 2006.
- [8] Mamta S. Kalas, " Real Time Face Detection And Tracking Using Opencv ", In Proc. International Journal Of Soft Computing And Artificial Intelligence, Vol.2, No.1, pp. 41-44, May 2014.



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- [9] Taranpreet Singh Ruprah, "Face Recognition Based On Pca Algorithm", In Proc. International Journal Of Computer Science And Informatics, Vol.2, No.1, pp. 221-225, 2010.
- [10] Mohan A. R., N. Sudha And Pramod K. Meher, "An Embedded Face Recognition System On A VLSI Array Architecture And Its FPGA Implementation", pp.2432-2437, 2010.
- [11] Shomo Engelberg, Yishai Saidoff And Yehezkel Israeli, "Voice Identification Through Spectral Analysis", In Proc. IEEE Instrumentation And Measurement Magazine, pp.52-55, Oct. 2006.
- [12] Junfeng Qian, Shiwei Ma, Zhonghua Hao And Yujie Shen, "Face Detection And Recognition Method Based On Skin Colour And Depth Information," pp.345-348, 2011.
- [13] Rami Badaoui, Adel Al-Jumaily, "Fuzzy Logic Based Human Detection For CCTV Recording Application", PP. 336-341 2007.
- [14] Renald Buttermore, Naseem Lee-Perkins, "Developments In Voice Recognition Technology", pp. 01-07 Mar. 2013.