Automatic Door Access using Face Detection

Sumit Shrivastav[1] Zohair Siddiqui[2] Manmeet Singh[3]
[1,2,3]Student
[1,2,3]Department of Computer Engineering
[1,2,3]Thakur Polytechnic, Thakur Complex, Maharashtra, India

Abstract— The emergence of high-resolution digital cameras for recording of still images and video streams that has had a significant impact on how communication and entertainment have developed during the recent years. At the same time Moore's law has made too many computing powers readily available that only some 20 years ago was reserved for high profile research establishments and intelligence services. These two tendencies have respectively called for and fostered the advent of unprecedented computationally heavy image processing algorithms. Algorithms that in turn have allowed for new processing of existing image based material. Parallel to this technological development the measures deployed in the protection against attacks from the enemies of modernity calls for more surveillance of the public space. As a result of this regrettable circumstance more video cameras are installed in airports, on stations and even on open streets in major cities. Whether or not the purpose is entertainment or dead serious surveillance, tasks like detection and recognition of faces are solved using the same methods. Due to the varying and generally adverse conditions under which images are recorded there is a call for algorithms which is capable of working in an unconstrained environment.

Key words: Digital Cameras, Real Time, Face, Detection

I. INTRODUCTION

The purpose of this project is to implement and thereby recreate the face detection algorithm. This algorithm should be capable of functioning in an unconstrained environment meaning that it should detect all visible faces in any conceivable image. The ideal goal of any face detection algorithm is to perform on par with a human inspecting the same image, but this project will constrain itself to only match the figures posted by Viola-Jones. In order to guarantee optimum performance of the developed algorithm the vast majority of images used for training, evaluation and testing are either found on the internet or taken from private collections. In other words, these images are not created under controlled conditions and are therefore believed to be a trustworthy representation of the unconstrained environment in which the face detector is expected to work.

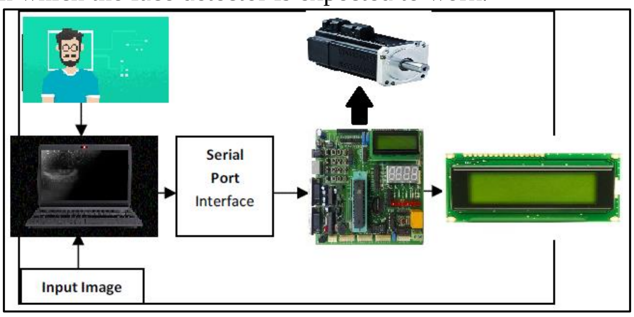
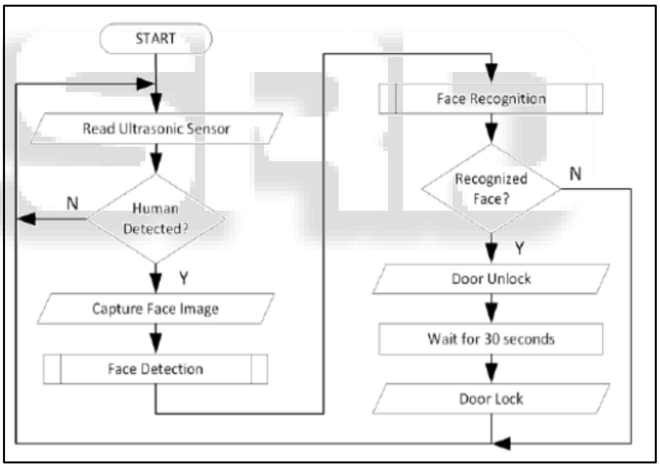


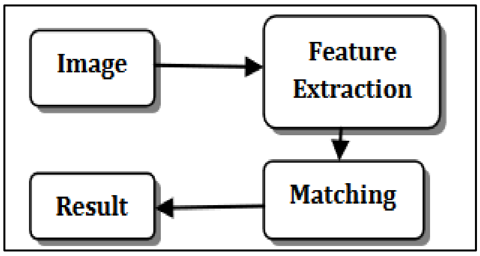
Fig. 1: Block Diagram of Face Recognition system with hardware interfacing

There are three main contributions of our face detection framework. We will introduce each of these ideas briefly below and then describe them in detail in subsequent sections. The first contribution of this paper is a new image representation called an integral image that allows for very fast feature evaluation. Motivated in part by the work of Papa georgiouet al. (1998) our detection system does not work directly with image intensities. Likethese authors we use a set of features which are reminiscent of Haar Basis functions (though we will also use related filters which are more complex than Haarfilters). In order to compute these features very rapidly at many scales we introduce the integral image representation for images (the integral image is very similar to the summed area table used in computer graphics (Crow, 1984) for texture mapping). The integral image can be computed from an image using a few operations per pixel. Once computed, any one of these Haar-like features can be computed at any scale or location in constant time.

A. *Activity Diagram*



B. *E-R Diagram*



II. GOALS & OBJECTIVES

– To minimize the shortcoming of existing system and integrate remotely controlled system with cloud-based services.
– Automatic opening and closing of door to authorized person without human intervention.
– Centralized storage of data over the cloud to overcome disk space issues and data integrity.

- Allow the system to be used around with various mobile platforms.
- Real-time notification to the user using mobile and cloud services platform.
- Lastly, a cost-effective system in order to justify its application in home automation.

III. PROPOSED SYSTEM

The proposed model is a system accessible over cloud. It makes use of raspberry pi over microcontrollers providing many advantages and features. The proposed system supports more elasticity, comfort, easily accessible and remotely controllable. The system also attempts to provide every possible benefit of automation, computer vision, cloud computing and embedded systems. The shown system architecture shows the interconnection and the relationships between the software components and the hardware components which helps in implementing the entire system.

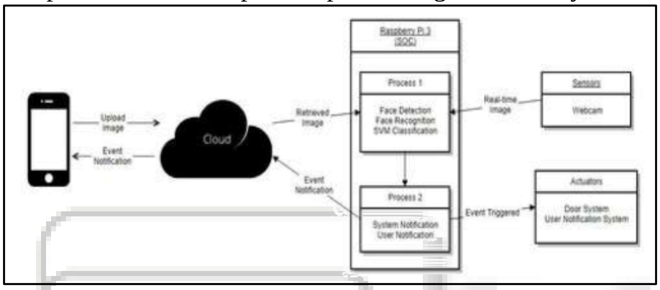


Fig. 2: System Architecture

IV. IMPLEMENTATION

Matlab2014a is used for coding. In the database folder, 50different facial part of images for ten persons are used as the training images. While making the database folder, the captured images are applied and cropped by face detection module in order to obtain the only facial parts of all images with different directions, For instance, five images of a person with different face directions are shown in the above figure.

All training images are reshaped and converted into 125x125 grayscale images by using resize and rgb2graymatlab built-in function. Mean centered (or subtracted) images are evaluated by subtracting average image from the original training image. The eigenvectors corresponding to the covariance matrix define the Eigen faces which look like ghostly faces. Since 50 training images are used, 50 eigenfaces are obtained. Some eigenfaces of the training images are shown in fig.

V. FEATURES

The scale invariant detector the first step of the Viola-Jones face detection algorithm is to turn the input image into an integral image. This is done by making each pixel equal to the entire sum of all pixels above and to the left of the concerned pixel. This is demonstrated in figure

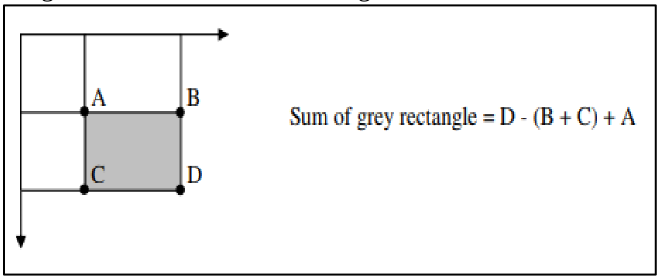
1	1	1
1	1	1
1	1	1

Input image

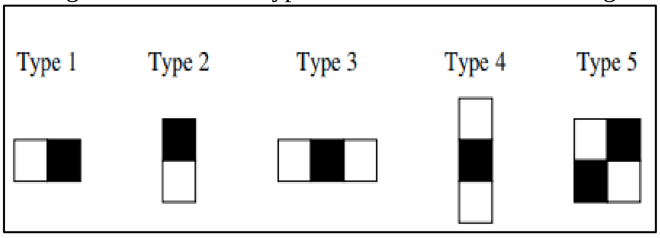
1	2	3
2	4	6
3	6	9

Integral image

The integral image: This allows for the calculation of the sum of all pixels inside any given rectangle using only four values. These values are the pixels in the integral image that coincide with the corners of the rectangle in the input image. This is demonstrated in Figure



Sum calculation: Since both rectangle B and C include rectangle A the sum of A has to be added to the calculation. It has now been demonstrated how the sum of pixels within rectangles of arbitrary size can be calculated in constant time. The Viola-Jones face detector analyzes a given sub-window using features consisting of two or more rectangles. The different types of features are shown in Figure



A. The Different Types of Features:

Each feature results in a single value which is calculated by subtracting the sum of the white rectangle(s) from the sum of the black rectangle(s). Viola-Jones have empirically found that a detector with a base resolution of 24*24 pixels gives satisfactory results. When allowing for all possible sizes and positions of the features in Figure 4 a total of approximately 160.000 different features can then be constructed. Thus, the amount of possible features vastly outnumbers the 576 pixels contained in the detector at base resolution. These features may seem overly simple to perform such an advanced task as face detection, but what the features lack in complexity they most certainly have in computational efficiency. One could understand the features as the computer's way of perceiving an input image. The hope being that some features will yield large values when on top of a face. Of course operations could also be carried out directly on the raw pixels, but the variation due to different pose and individual characteristics would be expected to hamper this approach. The goal is now to smartly construct a mesh of features capable of detecting faces and this is the topic of the next section.

VI. Future Scope

Imaging can be defined as the representation of an objects external form. That definition no longer holds true. More information within an image can be considered. Fluorescent tags, mechanical-biological parameters, internal structures are some of the recent additions. Fabrication while imaging and the characterization of materials as yet undefined can also be part of imaging. The extremely small images can be measured in nanometers also. Future imaging systems are expected to be less expensive. They will have to be easier to use. There are various types of imaging systems such as those used for chemical, optical, thermal, medical and molecular imaging. The use of scanning techniques and statistical analyses for image analysis are needed to extract valid image values. The satellite applications programs of the future will be based on extensive research in the area of imaging. A number of different sensors will be used in the satellites orbiting the earth. Scientifically useful information will be extracted from these systems. New techniques will be needed to organize and classify the different sets of data obtainable from the orbiting satellites. The future trend in remote sensing will be based on sensors that can record the same scene in many different ways. Graphics data will be important in image processing app1ications. Satellite based imaging for planetary exploration as well as military applications will be the future trend. Biomedical applications, astronomy, and scene analysis for the robotic vehicles are also pertinent areas of future applications of imaging4. Adaptive search of large image data bases will become the norms, since video and graphics data will be available from a variety of sensors developed for remote sensing applications of satellite systems. The design and coordination of microscopy imaging techniques for research in molecular biology is gaining importance.

VII. Conclusion

In PCA based face recognition, increase in the number of Eigen value will increase the recognition rate. However, the recognition rate saturates after a certain amount of increase in the Eigen value. Increasing the number of images and variety of sample images in the covariance matrix increases the recognition rate however noisy image decrease the recognition accuracy. In general, the image size is not important for a PCA based face recognition system. Expression and pose have minimal effect to the recognition rate while illumination has great impact on the recognition accuracy. As such, continuous works have been carried out in order to achieve satisfactory results of face recognition system. All this discussion provides useful performance evaluation criteria for optimal design and testing of human face recognition system.

References

[1] Paul Viola, Michael J. Jones, Robust Real-Time Face Detection, International Journal of Cumputer Vision 57(2), 2004.

[2] Ayushi Gupta, Ekta Sharma, NehaSachan and Neha Tiwari. Door Lock System through Face Recognition Using MATLAB. International Journal of Scientific Research in Computer Science and Engineering, Vol1, Issue-3, 30 June 2013.

[3] Daniel Georgescu, A Real-Time Face Recognition System Using Eigenfaces, Journal of Mobile, Embedded and Distributed Systems, vol. III, no. 4, 2011.

[4] Ole Helvig Jensen, Implementing the Viola-Jones Face Detection Algorithm, 2008.

[5] M. A. Turk and A. P. Pentland. Eigenfaces for Recognition. Journal of Cognitive Neuroscience, 3(1):71 - 86, 1991.

[6] M. A. Turk and A. P. Pentland. Face recognition using eigenfaces. IEEE Computer SocietyConference on Computer Vision and Pattern Recognition, CVPR 91, pages 586 - 591, 1991.

[7] I.Yugashini, S. Vidhyasri, K.Gayathri Devi, Design And Implementation Of Automated Door Accsessing System With Face Recognition, International Journal of Science and Modern Engineering(IJISME), Volume-1, Issue-12, November 2013.

