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Design & Implementation of Face Detection & Matching using Raspberry Pi

Bhaghyashri Pol[1], Prof. Dr. S. L. Lahudkar[2]

PG. Students, Department of Electronics and Telecommunication Engg. (Signal Processing),

Imperial COE, Pune, Maharashtra, India

Assistant Professor, Department of Electronics and Telecommunication Engg. (Signal Processing),

Imperial , COE, PuneMaharashtra, India

ABSTRACT: Biometric access systems have come a long way. Methods such as voice based access, speaker recognition;finger print recognition, password key systems and face recognition are a few important modes of biometric access systems. Face recognition, verification of authenticity based on the matching of a person's face, is a complex algorithm involving several methods. This paper aims to implement a face recognition software code based on the method of Haar Cascade Classifiers and to successfully implement this code on the Raspberry Pi platform for real time recognition. In this paper, an attempt to implement face recognition algorithm on a hardware platform, which is simple, yet efficient in usage is taken up.The Raspberry Pi development platform used is based on a BCM2835 System-on-Chip sporting an ARM11 processor and Image capture device is based on a linux compliant USB webcam. The software codes for both detection and recognition of faces are written using Opencv and Python.

KEYWORDS: System On Chip (SoC), CPU And GPU, ARM11

I. INTRODUCTION

Face detection [2] is now a day widely acceptable due to high accuracy and uniqueness over biometric system like fingerprint or iris recognition. The human face plays an important role in our day to day life, conveying people identify. Every person has their own face identity. This paper uses technique which totally independent on facial expression which affects on recognition system. Web cam take a picture and using face descriptor tool face recognition completed with database which already stored on raspberry pi [1] and information displayed on output screen. Face descriptor tool used for face recognition with three aspects as detect a face to track, identify facial feature to track and track the face [4] Feature extraction is dimensionality reduction technique. This approach is useful when image size are larger. Main aim of feature extraction is to represent the information of original image in lower dimensionality space with operations such as edge detection, corner detection of image. Common programming language software such as matlabprovide feature extraction technique. Feature extraction techniques uses less power, less memory and provide output with sufficient accuracy [3].web cam's images in the form of R,G,B (red, green, blue) shown in fig. 1 This coloured image containing R, G, B components and for edge matching technique convert this coloured image to grey image. 8 bit coloured image has 256 shades of each R, G, B, so it increases the complexity of techniques. Convert RGB values to ycbcrcolour space(y= luminance and chrominance = cb and cr).

To get actual image size calculate the maximum and minimum of the image. During this procedure original image can be blurred so as to prevent this problem lightning compensation technique used.Blob detection method is used for detecting different region of face that differ in properties such as brightness or colour as compared to surrounding region. According to face descriptor tool convert coloured image to grey image in which skin part made white and non-skin part such as eye and mouth is darkened shown in fig. 2 and by using dimension of grey image detect and recognize the image. Grey images uses in between 0 and 1 pixels hence calculation is easy and complexity is reduced as compared to coloured image

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II. IMPLEMENTATION

The Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote the teaching of basic computer science in schools and in developing countries. The original model became far more popular than anticipated, selling outside of its target market for uses such as robotics. Peripherals (including keyboards, mice and cases) are not included with the Raspberry Pi. Some accessories however have been included in several official and unofficial bundles. According to the Raspberry Pi Foundation, over 5 million Raspberry Pis have been sold before February 2015, making it the best-selling British computer. By November 2016 they had sold 11 million units.

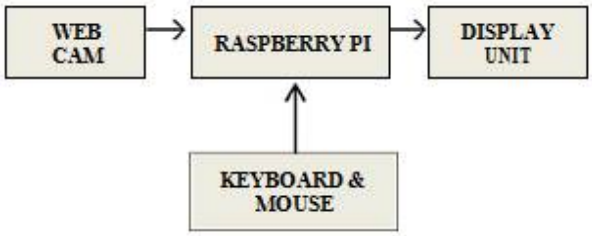

Fig1.Sytem Implementation

III. METHODOLOGY

OpenCV comes with a trainer as well as detector. If you want to train your own classifier for any object like car, planes etc. you can use OpenCV to create one. Its full details are given here: Cascade Classifier Training.

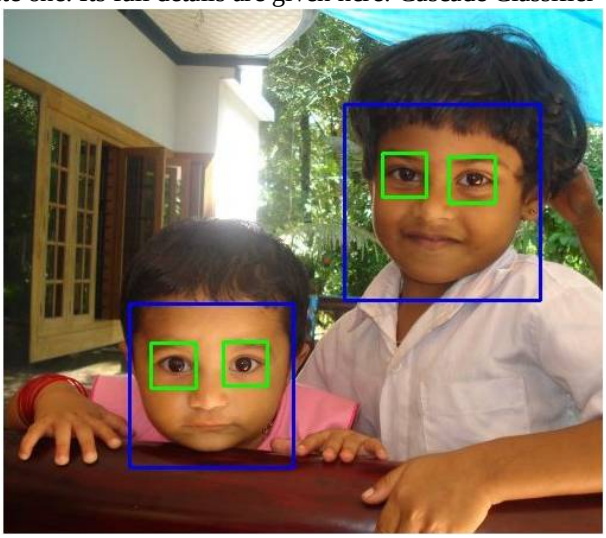

Fig2. Face Detection using Haar Cascade Classifier

Here we will deal with detection. OpenCV already contains many pre-trained classifiers for face, eyes, smile etc. Those XML files are stored in opencv/data/haarcascades/ folder. Let's create face and eye detector with OpenCV.
The system is programmed using Python programming language.We have developed three algorithms, for face detection from a given image, from a folder of images and for real time face detection.

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A. Face detection from a given image

Histogram equalization is done on the input image. Haar classifier is used for image calculation process and once face is detected, a red bounding box is drawn on the detected face. Detected face and sub faces are saved and time taken for detection is printed.

B. Face detection from a folder of images

After Histogram equalization of the given image, Haar classifier is again used for image calculation process. The difference from the first algorithm is that in addition to saving the detected face to a specified folder, the algorithm also checks if each image belongs to the source directory. If yes, the current file is named as a valid image with the file name. Otherwise, the file is named as an invalid image.

C. Real time face detection

Video is captured real time using the webcam. As long as a face is detected, a red bounding box is drawn and the video is displayed in the output window. The algorithm is efficient enough to detect multiple faces also.

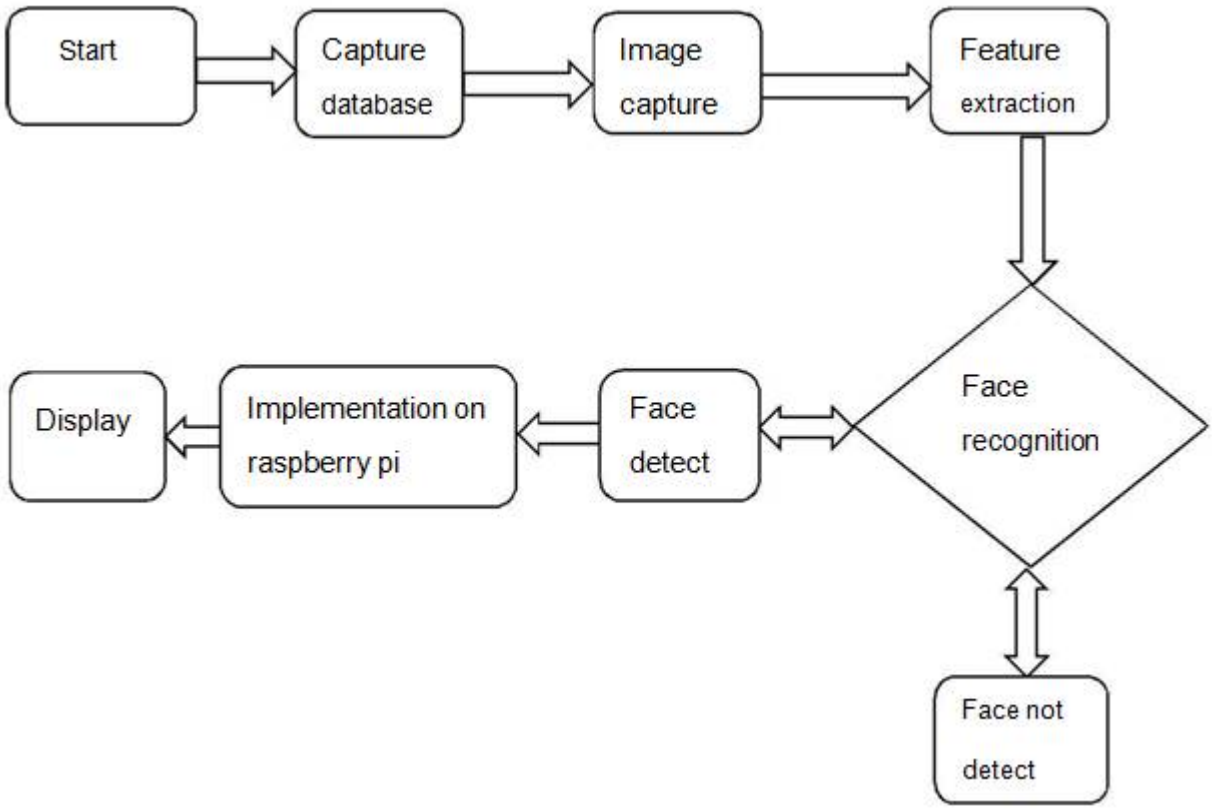

Fig 3: Image Capturing from webcam & Face Recognition and detection

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IV. WORKING

This system base on ARM 11 Raspberry Pi 3 module which are capable for processing of the Live video & image processing using onboard GPU facility. This system also consist of Webcam used to capture the images of user. Using Haar Cascade classifier it is possible to detect the Face from an Capture Image. First it capturing the face & it putting into the database. After this it recognize the face based on the capture image & database image.Face detection is concerned with finding whether or not there are any faces in a given image and, if present,returns the image location and content of each face. Most face detection algorithms are designed in the software domain and have a high detection rate, but they often require several seconds to detect faces in a single image, a processing speed that is insufficient for real-time applications. This paper describes a simple and easy hardware implementation of face detection system using Raspberry Pi, which itself is a minicomputer of a credit card size and is of a very low price. The system is programmed using Python programming language. Both real time face detection and face detection from specific images, i.e. Object Recognition, is carried out and the proposed system is tested across various standard face databases, with and without noise and blurring effects. Efficiency of the system is analyzed by calculating the Face detection rate for each of the database. The results reveal that the proposed system can be used for face detection even from poor quality images and shows excellent performance efficiency

V. ACKNOWLEDGMENTS

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