International Journal of Emerging Engineering Research and Technology
Volume 2, Issue 8, November 2014, PP 1-7
ISSN 2349-4395 (Print) & ISSN 2349-4409 (Online)

Design of Intelligent Mobile Human Recognition and Location Identification System Based on Arm7 and Open CV

Donthigari Vinay Kumar
B.V. Raju Institute of Technology, Narsapur
Vinay.vny291@gmail.com

Mr. Sanjay Dubey
M.Tech (Ph.D)
Professor, ECE Dept
sanjay.dubey@bvrit.ac.in

Akbar Mohammad
Sr.Application Engineer
UniStringTech Solutions PvtLtd, Hyderabad
akbar@unistring.com

Abstract: *This paper describes the development of an intelligent mobile platform based Human face recognition and location identification system by using ARM. Automated face recognition have gained significant attention from the commercial and research sectors. This algorithm is implemented from the OpenCV library. Real time face Detection and recognition is the process of finding a 'face' within images or videos obtain from camera. There are currently commercially available systems for face recognition, but they are bulky, expensive, and proprietary. This paper aims to create a portable low-cost automatic mobile face recognition system using ARM microcontroller GPS and GSM.*

Keywords: *Human face recognition, OpenCV, GPS, GSM, ARM and LINUX*

1. INTRODUCTION

Face detection has attracted considerable attention over recent years in part due to the wide range of applications in which it forms the preliminary stage. Some of the main application areas include: human-computer interaction, biometrics, content-based image retrieval systems (CBIRS), video conferencing, surveillance systems, and more recently, photography. Another application area that can clearly benefit from face detection is surveillance systems that would allow easier identification of criminals in public spaces.

Generally face recognition is a big challenge as there is a chance of high uncertainty due to the external lighting conditions, so we are taking the advantage of gray scale images and PCA (Principle Component Analysis), which are less effected to the external environment changes. And mainly a prior step of this face recognition involves face detection which is also a big challenge. For this we are taking the help of pre-designed cascades whose detection of objects is satisfactory.

As OpenCV can support the entire Image and Signal processing algorithms and which can be ported onto the Linux platform very easily, so we can design the complete burglar proof system in such a way that which will have small size without compromising of any technical aspects. The major applications of this OpenCV include 2D & 3D feature extractions, Ego motion estimation, Facial recognition system, Gesture recognition, Human computer interaction, Mobile robotics, Motion understanding, Object identification, Motion tracking etc.

Face Detection and recognition is the process of finding a 'face' within images or videos and Face Recognition is the process of matching the detected 'face' to one of many the faces known to the file system. Now this system generates a command to perform location identification using GPS and forward the necessary information about the identified person using GSM. This system is aimed to locate any where to monitor and identity the persons along with location details using ARM microcontroller, Linux machine along with OpenCV, advanced communication technologies GPS and GSM.

2. SYSTEM DESIGN

The system consists of two units.

Unit1 consists of portable system with BSD Linux including OpenCV library, usb and serial port to perform the image processing part and communication functionality. Initially using an usb camera interface continuous images are captured and these images are processed with help of OpenCV and compared with existing database. If the current images are matching with any of the existing images the system generates command to the unit2.The unit 2 will perform the location identification using GPS and forward the necessary information about the identified person using GSM/GPRS to concern authorities.

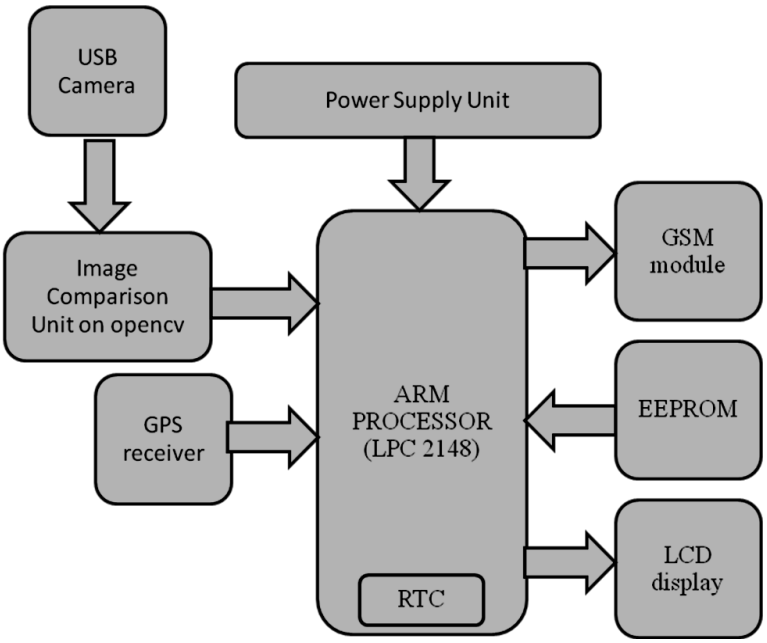

Fig1. *Block diagram*

This system has the following features:

1) *Video Capture:* When the system works, the camera starts capture the video using V4L Linux drivers. By using OpenCV library Video frames are converted into image, identifying the human face from this image by applying the face detection algorithm. Once human face is detected from the saved image the face part cropped, converted into monochrome image and store into local ROM memory these images are called real time images.

2) *Face Recognition:* In face recognition using the concept of Eigen values in order to r. In order achieve recognition data base images of required persons Eigen values at each and every pixel point is measured and stored in memory and measure the Eigen values at each and every pixel point from real time images. At last these two Eigen values are compared with respect to a threshold level, and based on threshold level human face recognizing declared.

3) *Communication Function:* The mobile platform communicates with the server center by the SMS message on the GSM net.

4) *GPS Positioning:* The system can correctly send the position and time of the checking vehicle to the server center by GPS positioning, therefore, the terminals can be coordinated properly.Same thing will be displayed on LCD display.

The detailed hardware composition is shown in figure 1.

3. SOFTWARE DESIGN

The design of software is so vital for the whole system. We propose a new approach for detecting human faces from color images under complex conditions such as non-uniform illumination, arbitrary image background. In face recognition Image processing algorithms (Eigen values) is used In the process of inputting human face, the USB camera, which could fix on to the PC, will used for acquiring the image of human face. Next step is that the image of human face would be processed by the image processing unit (BSD based Linux system). This system send the details of the person that is ID number and it compare the data base IDs and send the position of the person by GPS to server center via message through GSM.

3.1. Face Detection Algorithms

Face detection is a computer technology that determines the locations and sizes of human faces in arbitrary (digital) images. It detects facial features and ignores anything else, such as buildings, trees and bodies.

Haar-like Features is a recognition process can be much more efficient if it is based on the detection of features that encode some information about the class to be detected. This is the case of Haar-like features that encode the existence of oriented contrasts between regions in the image. A set of these features can be used to encode the contrasts exhibited by a human face and their special relationships. Haar-like features are so called because they are computed similar to the coefficients in Haar wavelet transforms. Figure 2 describes face detection features

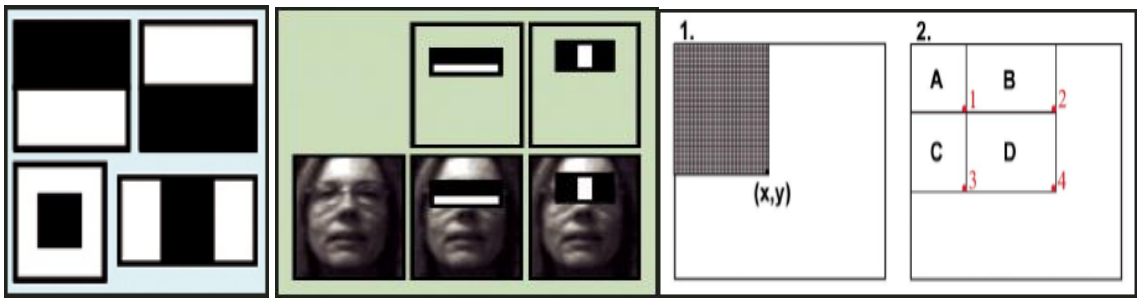

Fig2. *Face detection*

3.2. Cascade Haar Classifier

- Based on region of interact b/w a classifier and a live image
- Classifier is an image model
- Haar features: subsections of the image
- *Cascade:* Mechanism to find region of interact by applying the classifier subsequently

3.3. Face Recognition

The design of algorithm based on human-face recognition was very important for this system. Basically, the process of face recognition follows the face detection first. So as we are designing a basic prototype of human face detection and recognition system, we are taken the cascade classifiers which are already available in the OpenCV library for the face detection and the concept of Eigen values in order to recognition. Figure 3 describes the face recognition process.

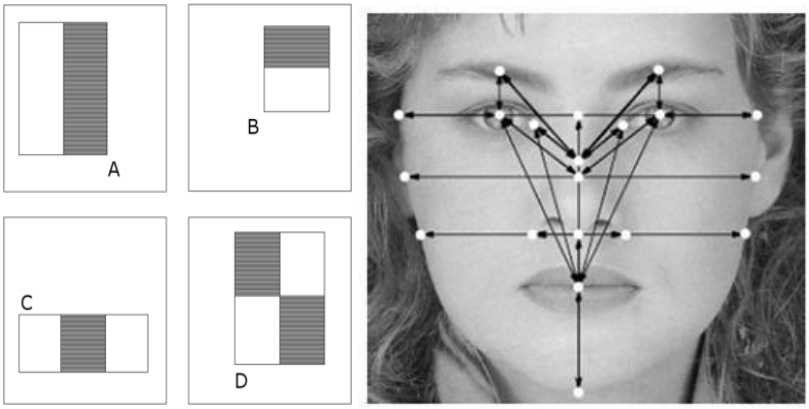

Fig3. *Face recognition process*

The steps used in eigenface are also used in many advanced methods. In fact, if you're interested in learning computer vision fundamentals, I recommend you learn about and implement eigenface, even if you *don't* plan to incorporate face recognition into a project! One reason eigenface is so important is that the basic principles behind it - PCA and distance-based matching - appear over and over in numerous computer vision and machine learning applications. Here's how recognition works: given example face images for each of several people, plus an unknown face image to recognize,

- Compute a "distance" between the new image and each of the example faces.
- Select the example image that's closest to the new one as the most likely known person.
- If the distance to that face image is above a threshold, "recognize" the image as that person, otherwise, classify the face as an "unknown" person
- Original image will result the scaled original image With respect to the minimal distance (Euclidean Distance) between two faces, recognize the person ID.

The process is mentioned figure 4.

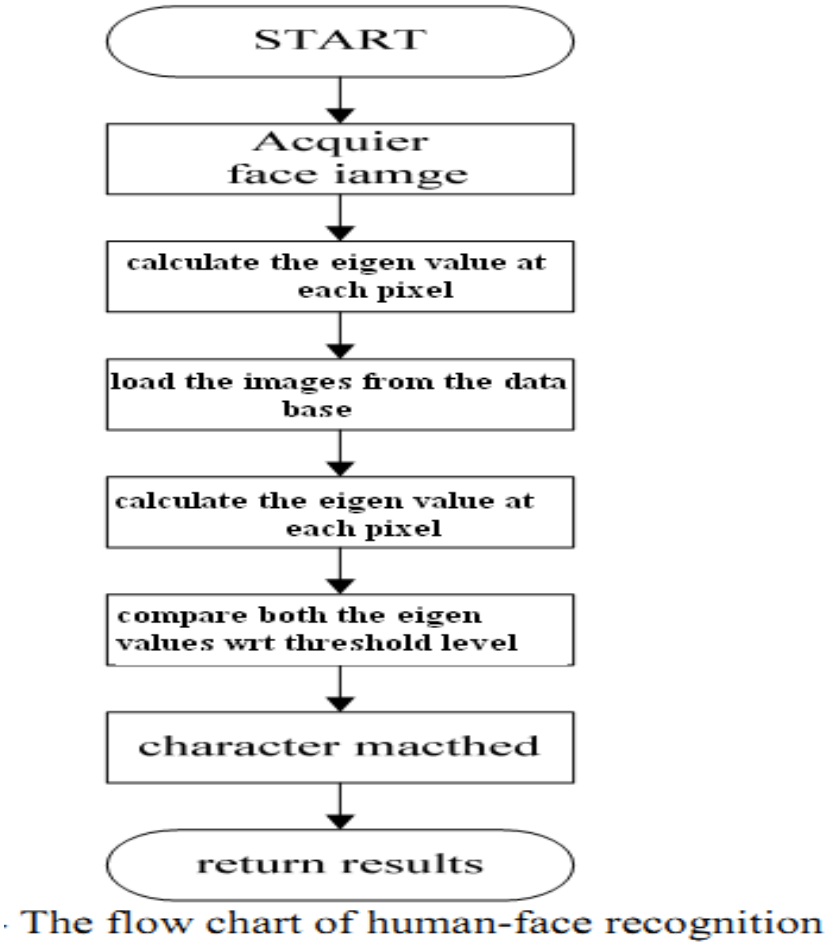

Fig4.

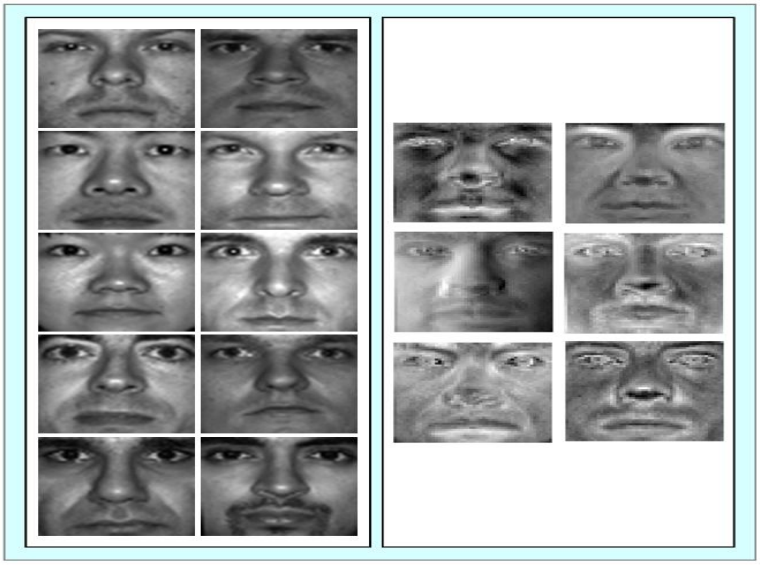

Fig4-1. *Eigen faces*

4. HARDWARE DESIGN

4.1. ARM7 Controller

ARM7 controller used in control system communicate the image comparison unit and communicates the GSM and GPS modules. The ARM7 controller receives id command from IMU via RS232 compare this with data based stored in EEPROM. if the ID matches with predefine one then the information such as particular name assigned to the ID, location of the person and time when the person is detected is send as a SMS to the server center.

The LPC2148 microcontrollers are based on a 32 bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combines the microcontroller with embedded high speed flash memory of 512 kB. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces the code by more than 30 % with minimal performance penalty.

Due to their tiny size and low power consumption, LPC2148 microcontrollers are ideal for the applications where miniaturization is a key requirement, such as access control and point-of-sale. A blend of serial communications interfaces ranging from a USB 2.0 Full Speed device, multiple UARTS, SPI, SSP to I2Cs and on-chip SRAM of 8 kB up to 40 kB, make these devices very well suited for communication.

4.2. GSM Module

SIM300 Module is used for GSM communication Designed for global market, SIM300 is a Tri-band GSM/GPRS engine that works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS 1900 MHz. SIM300 features GPRS multi-slot class 10/ class 8 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4.With a tiny configuration of 40mm x 33mm x 2.85mm , SIM300 can fit almost all the space requirements in our applications, such as smart phone, PDA phone and other mobile devices. In this hardware SIM300 is only interfaced with RS232, Regulated power Supply 4.0V SIM Tray Antenna with LED indications. Connectivity details mention in figure5.

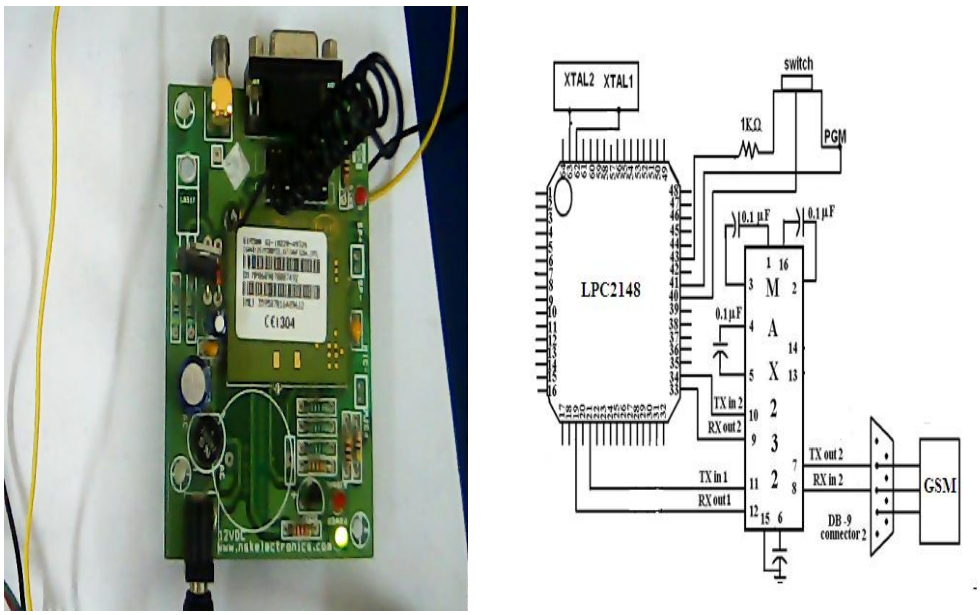

Fig5. *SIM900 GSM MODULE*

4.3. GPS Receiver

The GPS Smart Receiver is an ultra low power GPS receiver based on the proven technology found in this 16 channel GPS receivers and NEMERIX chipset solution. The positioning application meets strict needs such as car navigation, mapping, surveying, security, agriculture and so on. Only clear view of sky and certain power supply are necessary to the device. With its ultra low power consumption, the smart receiver tracks up to 16 satellites at a time, re-acquires satellite signals in 1 second (average) and updates position data every second. Connectivity details between gps and ARM7 mention in figure 6.

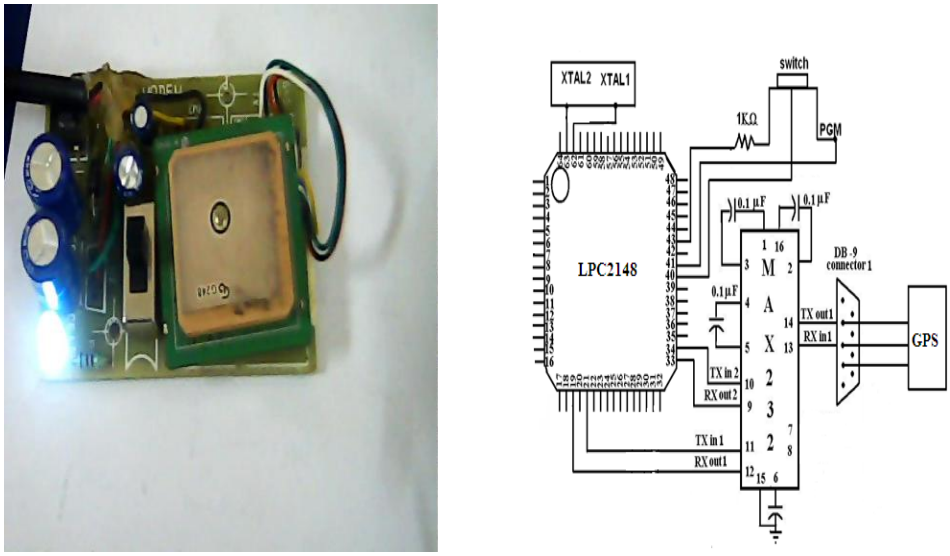

Fig6. *GPS Module*

5. RESULTS AND DISCUSSION

The experimental results obtained fulfils with the requirements of the system. The hardware and software results show in figure 7.

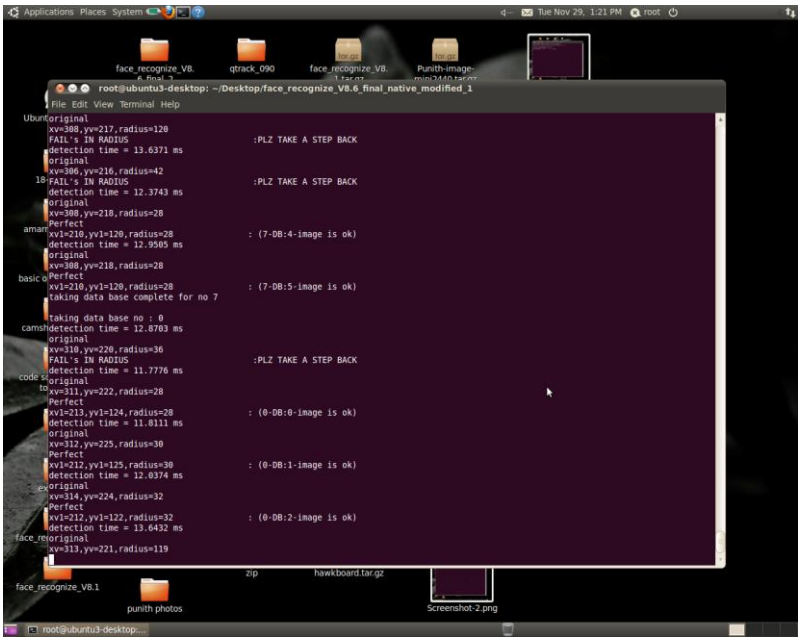

Fig 7.1

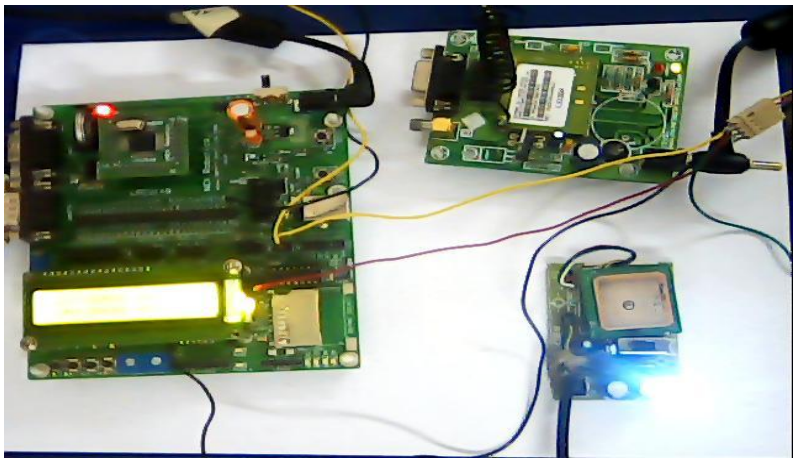

Fig7.2.*Results&Hardware integration*

The main objective of the implementation is the face recognition using OpenCV. FRS is used to detect the face of the required person and compare it with the predefined face. Once the person image matching with database image immediately control system will send person details along with location using GPS through SMS. This system prototype is built on the base of one embedded platform. The system has successfully implemented in the real time environment with capability to capture the object that appears in front of the camera in ten seconds.

6. CONCLUSION

As size and portability are the major unique advantages of the OpenCV, it can replace all other image and signal processing tools like MATLAB which is of very huge size and which can't be ported onto any device. The security features were enhanced largely for the stability and liability of human-face recognition.

The system was built on the technology of embedded system. The functions of whole system such as the GSM network and the GPS technology are perfect. The embedded system could verify effectively the person's identification by comparing the identification of database with the pre-defined database (human face).The location of the identified person is known by using GPS and the current time by real time clock. Thus the identified person's ID, location and time is send to the authentication's number by GSM network

REFERENCES

[1] Inigo R.M., Application of machine vision to traffic monitoring and control, IEEE Transactions on Vehicular Technology,1989,38(3):112-122

[2] XIE Yonghua, LIU Chuancai, YANG Jinyu(2008). Thealgorithm based on DDCT and TCSVD of human- face feature extraction and recognition".THE COMPUTE ENGENIERING, Vol. 08, No. 1, pp.3-4.

[3] Xiang Shuaiqiu, Zhan Shaobin, Jiang Tao, On the main technological schemes and algorithm for vehicle location system, Geospatial information, Vol 6, pp.87-90, June 2008 (In Chinese).

[4] M.S.Bayhan and M.Gokmen,||Scale and pose invariant real time face detection and tracking,||Proc. the 23rdInt.Symposium on Computer and Information Science,pp.1-6,October 2008.

[5] http://www.face-rec.org/

[6] http://hdfpga.blogspot.com/2011/04/face-detection-recognition-and-OpenCV.html

[7] http://www.cs.iit.edu/~agam/cs512/lect-notes/OpenCV-intro/OpenCV-intro.html

AUTHORS' BIOGRAPHY

Donthigari Vinay Kumar

B.V.Raju Institute of Technology, Narsapur

Mr.Sanjay Dubey

M.Tech (Ph.D), Professor, ECE Dept

Akbar Mohammad

Sr.Application Engineer, UniStringTech Solutions PvtLtd, Hyderabad