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The Design of Automotive Burglar-Proof Based on Human Face Recognition Using Open CV and Arm9

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Abstract: *With the development of science, the biological recognition technology which has much unique advantage, such as uniqueness, changeless, and so on, has been extraordinary improving. One of biological recognitions is human-face recognition. They provide a new idea to the vehicle burglarproof area. This system takes advantage of only character of human face feature recognition algorithm in which efficiency of recognition rate is considerable. We proposed that the whole system is built on the platform of embedded system which took advantage of the algorithm of human face recognition implemented from OpenCV library. The ARM9-based system combined with the traditional merits of vehicle burglarproof. At the same time, GSM network could be also used in the system.*

Keywords: *Open cv, GSM, ARM9, 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, 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. However, the number of vehicle theft crime has been rising when more and more vehicles are brought into our daily life. The vehicle owners concern about the issues that how to prevent the vehicle theft crimes. However, there are many bugs on the present vehicle burglarproof. In the traditional vehicle burglarproof areas, the common measures could be classified by several categories that they either rely on simple wireless control device to achieve the targets, or use the GSM network technology to achieve. Nevertheless, the functions of these devices are too simple to prevent the vehicle theft crimes from happening, furthermore, their burglarproof methods are not only character. The ARM9 chip is used as the core of this embedded system which is combined with the technologies of human-face recognition and GSM wireless communication. The new vehicle burglarproof system contained the function of human-face recognition and take advantage of the present ones. Our main goal is to develop face detection & recognition algorithms. Face detection algorithm using Haar-like features was described by Viola and Jones and a range of its modifications are widely spread in many applications. One of these modifications was implemented in OpenCV library. For face recognition Eigen face algorithm is developed.

2. SYSTEM DESIGN

System consists of human face acquisition unit and image data base. 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 and given it to GSM to make the user to know. When the crime happened or was about to doing, the messages of alarm would be sent to the vehicle owner as soon as possible.

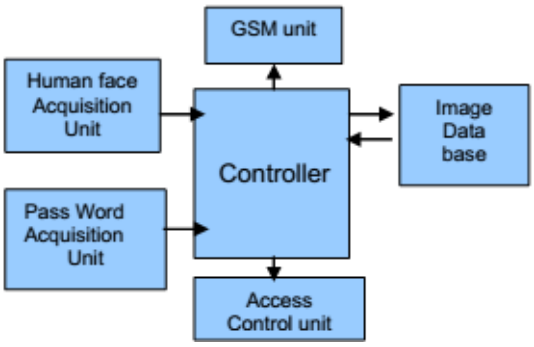

Fig1. *Block diagram*

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 through SMS. This system prototype is built on the base of one embedded platform.

This system has the following features:

Video Capture: When the system works, the camera starts capturing 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.

Features of OpenCV:

Image data manipulation

Basic GUI:

Display image/video, keyboard and mouse handling, scroll-bars

Face detection: In face detection, using Haar algorithm the face is going to be detected.

Face Recognition: In order to 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.

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

3. SOFTWARE DESIGN

The design of software is so vital for the whole system. This approach is 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 be 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 sends the details of the person that is ID number and it compare the data base IDs and send to user via message through GSM.

3.1. Haar Algorithm

Face detection is a computer technology that determines the locations and sizes of human faces in the object detector of OpenCV has been initially proposed by Paul Viola and improved by Rainer Lien hart. Haar algorithm is implemented for face detection. First, a classifier (namely a cascade of boosted classifiers working with Haar-like features) is trained with a few hundreds of sample views of a particular object (i.e., a face or a car).After a classifier is trained, it can be applied to a region of interest (of the same size as used during the training) in an input image 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.

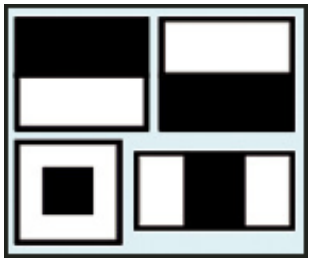

Fig2. *Haar features used in OpenCV*

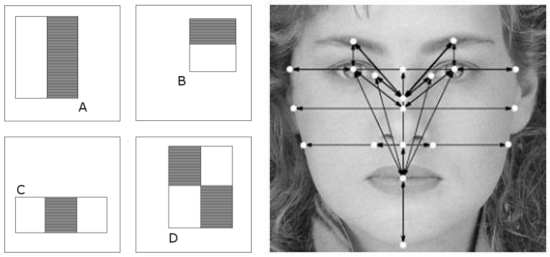

Fig3. *Haar features in the original Viola-Jones cascade*

Cascade Haar Classifier:

- Based on region of interact between 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.

Viola and Jones combined a series of AdaBoost classifiers as a filter chain, shown in Figure 4, that's especially efficient for classifying image regions. Each filter is a separate AdaBoost classifier with a fairly small number of weak classifiers.

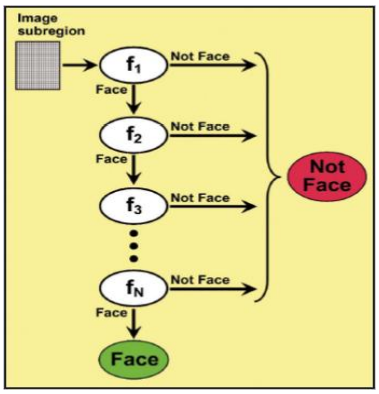

Fig4. *Cascade movement on the image*

Image regions that pass through all filters in the chain are classified as "Face." Viola and Jones dubbed this filtering chain a cascade. The order of filters in the cascade is based on the importance weighting that AdaBoost assigns. The more heavily weighted filters come first, to eliminate non-face image regions as quickly as possible.

3.2. Eigen Algorithm

This algorithm is implemented for 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 Open CV library for the

face detection and the concept of Eigen values in order to recognition. Eigen face is a set of Eigen vectors. Eigen vector is a value which is multiplied with original image will result the scaled original image with respect to the minimal distance (Euclidean Distance) between two faces, recognize the person ID.

How recognition works:

- 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

The process is mentioned in figure 5.

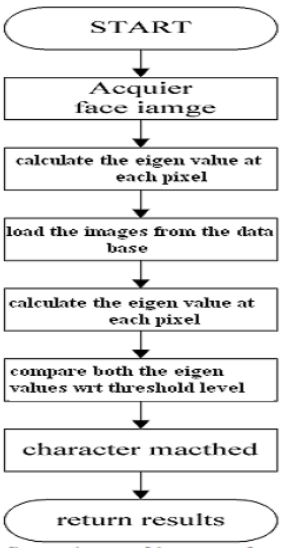

Fig5. *Steps for human face recognition*

Eigenvectors possess following properties:

- They can be determined only for square matrices
- There are n eigenvectors (and corresponding Eigen values) in an n × n matrix.
- All eigenvectors are perpendicular, i.e. at right angle with each other.

Fig6. *Eigen faces*

Eigen faces are interesting to look at, and give us some intuition about the principal components for our dataset. Each eigenvector represents the slope of a line in a 2,500 dimensional space. As in the 2D case, we need all 2,500 dimensions to define the slope of each line. While it's impossible to visualize a line in that many dimensions, we can view the eigenvectors in a different way.

4. HARDWARE DESIGN

4.1. ARM9 Controller

The ARM processor is a Reduced Instruction Set Computer (RISC). The ARM920T processor is a member of the ARM9TDMI family of general purpose microprocessors includes the ARM9TDMI core plus cache and MMU.

ARM9TDMI processor:

- Harvard architecture
- 5-stage pipeline
- 32-bit ARM instruction set and 16-bit THUMB instruction set.

Samsung's S3C2440A is designed to provide hand-held devices and general applications with low power and high performance microcontroller solution in small die size. The S3C2440A is developed with ARM920T core. It adopts a new bus architecture known as advanced micro controller bus architecture (AMBA).

4.2. GSM Module

GSM (Global System for Mobile communications) is a cellular network, which means that mobile phones connect to it by searching for cells in the immediate vicinity. GSM networks operate in four different frequency ranges. Most GSM networks operate in the 900 MHz or 1800 MHz bands. Some countries in the Americas use the 850 MHz and 1900 MHz bandsSIM300 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.

5. RESULTS AND DISCUSSION

The experimental results obtained fulfils with the requirements of the system.

Face Detection: While detecting a face it is going to give some instructions when it is taking images from webcam as shown in fig 8.

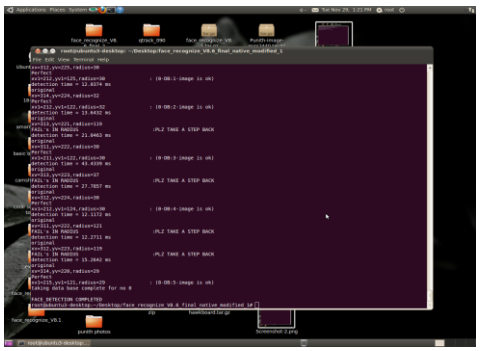

Fig7. *Face detection*

Face Recognition: In recognition, it is going to compare the database images with live part.

Fig8. *Face recognition*

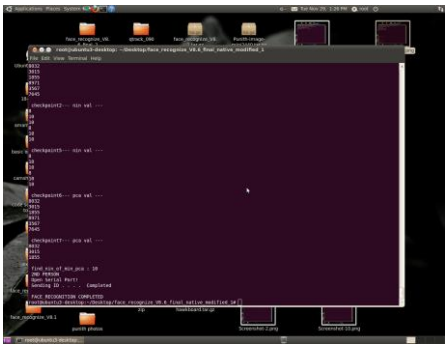

Fig9. *Analysis phase*

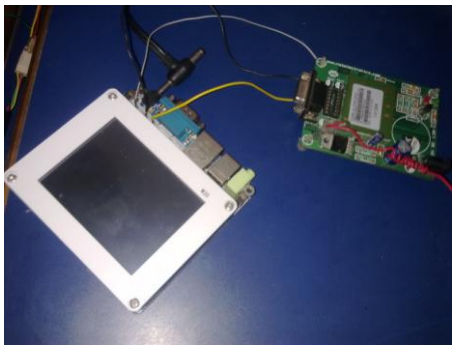

Fig10. *Hardware setup*

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 recognition rate of the complete system will be around 75% under testing conditions so this system is applicable to the middle level security/authentication systems

REFERENCES

[1] P. Viola, "Rapid object detection using a boosted cascade of simple features," Proceedings of IEEE Computer Society Conference on Computer Vision and Pattern Recognition (CVPR'01), vol.1, pp.511-518, 2001.

[2] R. Lien hart, "An extended set of Haar-like features for rapid Object detection", Proceedings of IEEE International Conference on Image Processing (ICIP'02), vol.1, pp.900-903, 2002.

[3] Open Computer Vision Library [Electronic resource], 2012, Mode of access: http://sourceforge. net/projects/OpenCV library. – Date of access: 25.06.2012.

[4] J .Owens, "GPU architecture overview," International Conference on Computer Graphics and Interactive Techniques (SIGRAPH'07), 2007.

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