International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395 -0056
Volume: 04 Issue: 03 | Mar -2017 www.irjet.net p-ISSN: 2395-0072

CRIMINAL IDENTIFICATION USING ARM7

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Abstract - *Personal information of a person and photograph is mainly used in criminal records. For identification of any criminal some identification marks regarding that person, given by eyewitness are needed. Many times it happens that the quality and resolution of the image recorded is poor and it becomes hard to recognize a face from it. This paper presents development of a software to overcome such kinds problem. Identification is possible through various ways such as, finger print, eyes, DNA etc. Most important of all applications is face recognition. Face is the prime center of attention in any social intercourse and plays the most vital role in conveying identity and expression. Though it is difficult to judge the mental ability or character from facial appearance , human beings can recognize several things from it significantly. This proposed system mainly consist of ARM7, GSM, GPS and camera interfacing. The cameras are placed in public places. If criminal's face gets detected in the camera, then connected computer will send signal to controller. Microcontroller will then send the location of criminal to predefined mobile number through GSM module.*

Key Words: Criminal identification, ARM7, GSM, GPS, MATLAB etc.

1. INTRODUCTION

The identification of criminals and terrorist is primary issue for police, Military and security forces. The terrorist activities and crime rate is increasing abnormally. To combat with these for identification of criminals & terrorists is a challenging task for all security departments. Security issue and protection of lives and public property are the primary concerns for all security departments. These departments are now-a-days using latest technology. This paper is an attempt to use data mining concept and will provide comprehensive data base of criminals and terrorist and will be great support for all above mentioned departments. To help the security forces data mining concepts proved to yield better results in this direction.

This system uses a combination of location detection and face recognition. Face is one of the most prominent biometric identification techniques, to identify criminals. Today whole world is suffering from increasing terrorist and criminal activities and causes a major threat to the security of a country and its civilians. To identify terrorist and criminals and record their details, security and law enforcement agencies should have the necessary technology when a suspect is apprehended. As human beings, have the inborn ability to recognize and distinguish between faces. However, this kind of intelligence is not available yet with computers. In order to emulate this kind of problem it needs training. Researchers and software developers have develop various applications in which different algorithms and mathematical modules are implemented for criminal/terrorist identification.

Face detection is a computer technology that determines The locations and sizes of human faces in arbitrary images are determined by face detection algorithm which detects facial features and ignores anything else, such as trees, bodies and buildings etc[1][2]. This system recognizes faces from images with some near real-time variations and proved to be efficient system. The systems implements and verify the algorithm. The approach consist of weighting the difference between a mean image, which is obtained by averaging a predefined set of faces and a given face image. The training set is a group of face images from which the mean face is calculated. The weighting difference between set of eigenvectors and linear projection of image on low dimensional image space is obtained for weighted Face detection.[3]

Face recognition: Face recognition scheme of human identification is probably the most user friendly and non-intrusive authentication method available and is one of the most acceptable biometric techniques utilized in various real-world applications. The developing of face recognition system is quite difficult because the human face is quite complex, multidimensional and corresponding on environment changes. This research is focused on developing the versatile computational model of face recognition which is accurate, simple and fast when implemented in different environments. Here, the use of SIFT algorithm for face detection is recommended. This is most successful techniques that have been used to recognize faces in images. However, a major problem of this technique is dimensionality large and high computational cost .

1. LITERATURE REVIEW

For identification of terrorist/criminals with higher precision use of web-based multimodal biometrics system with a centralized database that uses face recognition and fingerprint identification.[4] This system makes use of the distance between nodal points to match face images for the principle Component Analysis based face recognition technique[5].

Many research on automated face recognition has been done from 1970. Since then many algorithms and techniques have been designed and implemented, each one trying to provide better efficiency and accuracy than the earlier one. It is also expected exhaustive use of biometric analysis in many practical applications and with advancing technology each day. In this paper a feature based algorithm for face recognition and efficiency of Scale-invariant feature transform (SIFT) are explained[6][7]. Overview of the SIFT algorithm, the experiment conducted to carry out the research finding accuracy and efficiency of the algorithm are included in this paper. Use of the experimental data and application of inferential and descriptive statistics on the obtained data, strong results are obtained that gives explored analysis of SIFT algorithm and its accuracy.

SYSTEM ARCHITECTURE

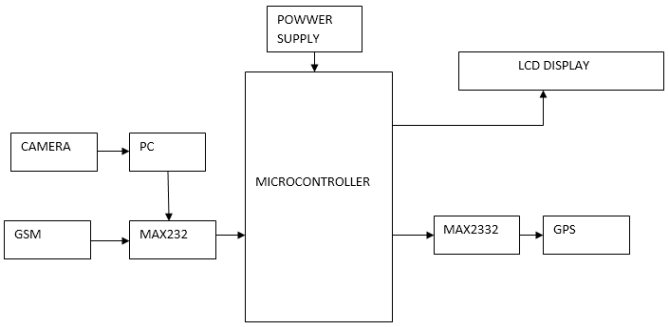

Fig -1: Block diagram of the system

This system is mainly divided into two parts. One is controller and other is face detection through MATLAB. The controller side is having two wireless modem, GSM and GPS. If criminal's face is detected in camera then GSM modem will send message of that location to authorized mobile number. For face detection, here digital cameras are used which are connected to a computer system. The computer is having database stored in which all criminals' photos are saved. If database is matched with any of the face caught by camera then signal is sent to controller.

SIFT algorithm:

SIFT algorithm is broadly divided in 4 procedures for ease of computation.

i) Scale-space extreme detection: It's use is in detecting blob structures in any image. A scale space is created from the convolution of a variable-scale Gaussian, $G(x, y, \sigma 2)$ with an input image, $I(x, y)$. In this interest points, in an image called key points in the SIFT framework are detected.

According to the study by Lindeberg, the normalization of the Laplacian, $\sigma 2$ 2G with the factor $\sigma 2$ is required for true scale invariance. Through this automatic scale selection in the image is obtained after convolution with the normalized Laplacian function .[6][7][8]

As proven earlier that if the scale of the image structure is close to the value of normalized Laplacian function, the output $O(x, y, \sigma 2)$ derived from convolution of the image with $\sigma 2$ 2G will be extreme. In this way for the detection of blob structures and their representation at the most optimal scale, the extrema points which are in both spatial and scale spaces are selected.

ii) Removal of unreliable key points : Here the value of $|O(x, y, \sigma 2)|$ at each key point is evaluated. If this obtained value is below some defined threshold then it means that the structure has low contrast (and is therefore sensitive to noise), such a detected key point will be removed.

For poorly denned peaks in the scale-normalized Laplacian of Gaussian operators, the key point is kept only if ratio of principal curvatures of each candidate key point evaluated is below some threshold.

iii) Assigning Orientation: In here, every key point is assigned one or more orientations based on local image gradient directions.

iv) Key point descriptor: In the final step the image gradient magnitudes and orientations calculated in step iii) are sampled around the key point location. Sampling is performed using the scale of the key point to select the level of Gaussian blur for the image. The feature descriptor finally is calculated as a set of orientation histograms on 16×16 pixel neighbours around the key point. Each histogram in orientation consists of 8 bins, and each descriptor contains a 4×4 array of histograms around the key point. As a result the feature vector for each key point comes out to be $4 \times 4 \times 8 = 128$ dimension.

4. COMPONENTS OF THE SYSTEM

A. Microcontroller:

The ARM7 is a general purpose microprocessor, that provides a high performance and very low power consumption at the same time. The ARM controller uses Reduced Instruction Set Computer (RISC) principles. The instruction set and decode mechanism are very much simpler than Complex Instruction Set Computers (CISC). As a result of all this a high instruction throughput and good real-time interrupt response from is achieved along with small and cost-effective core of processor. All parts of the

processing and memory systems operate continuously due to pipeline techniques used. In this pipeline architecture at a time when one instruction is being executed, the next instruction to be executed gets decoded, and a third instruction is fetched from memory. The ARM7 processor also utilizes an architectural strategy called Thumb. It's an unique strategy that makes it ideal for large-volume applications having memory restrictions, or some other applications in which code density proves to be an obstacle. Basic idea of Thumb instruction is a super-reduced instruction set.

B. Global Positioning System (GPS)

The Global Positioning System (GPS) is a satellite-based navigation system. This system provides location along with time information anywhere on or near the Earth.

An unobstructed line of sight to four or more GPS satellites is required for precise locating. The system has proven critically useful to military, and commercial users around the world. A GPS tracking device accurately calculates geographical location through the information received from GPS satellites. The Global Positioning System is a system consisting of a network of a minimum of 24, but currently 30, satellites orbiting around earth placed by the U.S. Department of Defense.[9][10]

Fig -2: GPS module

C. GLOBAL SYSTEM FOR MOBILE (GSM):

This is a modem which is very flexible plug and play quad band GSM modem. It has direct and easy integration to RS232 serial communication. It provides support to various features like Voice, Data, SMS, GPRS and in TCP/IP stack.[11]

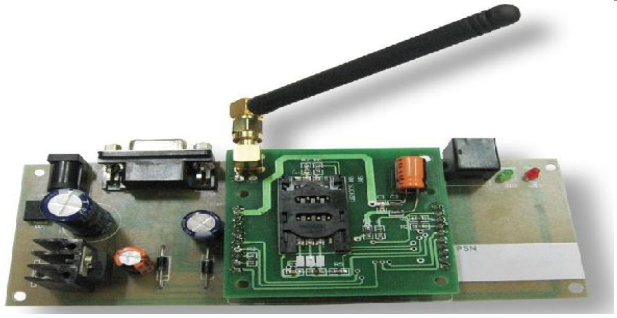

Fig -3: GSM module

D. MAX 232:

MAX232 is an IC, initially developed by Maxim Integrated Products, in 1987. This IC is used to convert signals received from an RS-232 serial port to make signals suitable for use in TTL digital logic circuits. The MAX232 is a dual transmitter/receiver and usually converts the RX, TX, CTS and RTS signals. The receivers down convert RS-232 inputs (typically of range ± 25 V), to standard 5 V TTL levels.

E. LCD Display (16x2):

It is a 2 line display with 16 characters per line. In this project LCD is working in 4-bit mode i.e., the data transferred to the LCD must be in 4-bit data form. One Port of controller is connected to data pins of LCD. Other port defines control pins (Rs, R/W and En). LCD has of 3 control lines namely RS,R/W & EN and uses eight data lines (D0-D7). Supply voltage (Vcc) and contrast control (Vee) are other important pins while (Vss) is ground pin.

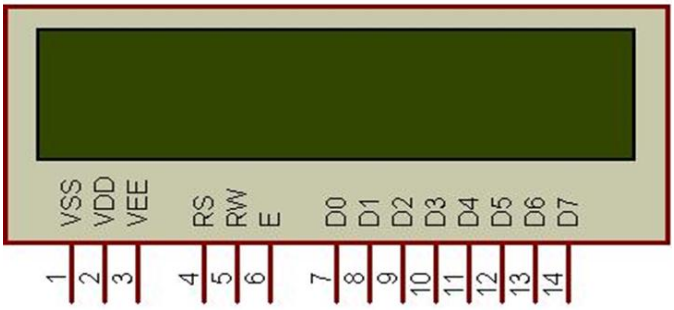

Fig -4: 16*2 LCD pin diagram

5. CONCLUSION AND FUTURE SCOPE

Our research is based on identifying criminals using multimodal approach; hence in this research we built a system to identify criminals using face recognition. We found a new algorithm based on the SIFT to recognize face images which is computationally feasible in the practical environment and also provides dynamic training when adding criminals to the database. To minimize the computational cost of the algorithm used, we have introduced a feature vector instead of pixels. To test the recognition rates we conducted experiments for each component. To find the accuracy of each search component, we have considered the recognition rate of identifying both male and female criminals with in top 10 matches in each experiment. As a future development, we can suggest testing with a larger database of face images, with large variation. The system was not tested for special cases like face alterations by doing plastic surgery. This method can further be improved using more significant features of face.

ACKNOWLEDGEMENT

Authors would like to acknowledge the Principal, Head of department and project coordinators of the project for all the support and help provided. To express deepest feeling of appreciation to the corresponding guardians for giving the motivation required till the completion of paper.

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