Anti Theft Mechanism through Face Recognition

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Abstract: Face Recognition concept is one of the successful and important applications of image analysis. It's a holistic approach towards the technology and have potential applications in various areas such as Biometrics, Information society, Smart cards, Access control etc. A face recognition technology is used to automatically identify a person through a digital image. It is mainly used in security systems. The face recognition will directly capture information about the shapes of faces. The main advantage of facial recognition is it identifies each individual's skin tone of a human face's surface, like the curves of the eye hole, nose, and lips, etc. this technology may also be used in very dark condition. It can view the face in different angles to identify.

Also this is use in vehicle security. The use of vehicle is must for everyone. At the same time, protection from theft is also very important. Prevention of vehicle theft can be done remotely by an authorized person. The purpose Embedded Car Security System captures the image using a camera which will be hidden in the dash board. Face Detection Algorithm is used to detect the face. A database is created by taking the pictures of all the family members. A minimum of ten photos of each family member is taken. This captured image is compared with the already present database using PCA algorithm. Once the captured face matches with the already present database a message is sent to the owner of the vehicle stating "Match Found". Otherwise, if the captured face does not match with the database then the processor activates the GPS module and the GSM module. Using the GPS module the location of the vehicle is found out. This location is sent through the GSM module to the owner of the vehicle. Also along with the location, the image of the driver is sent through MMS to the owner.

Keywords: Face Detection System (FDS), Short Message Service (SMS), Global System for Mobile (GSM), Global Positioning System (GPS).

I. INTRODUCTION

With the development and applications of many embedded techniques, car security system design and analyses are constantly improving. Many new techniques, such as biometric recognition technique, image processing technique, communication technique and so on, have been integrated into car security systems. Biometric and non-biometric methods usually provide such security features. Sometimes these systems fail due to hacked password and encryption of decrypted data, but it is almost impossible to make replica of distinctive characteristics. Biometric systems are modern and use techniques like fingerprint recognition, iris recognition and face recognition.

Of these face recognition and detection systems are more sophisticated, easy to deploy and people can be identified without their knowledge. Some advantages of facial recognition method for vehicle security application are:-

1. More convenient, sensed as soon as one is seated in position.
2. Low cost and a better approach to be used with existing methods.
3. Requires no active part of the user.

Using face recognition methods for security purposes is one of the best and accurate methods for law enforcement. It is also very useful for commercial applications. Although we can find many other identification and verification techniques, the main motivation for face recognition is because it is considered a passive, no intrusive system to verify and identify people. There are numerous methods employed in face detection.

II. LITERATURE STUDY

The existing car anti theft system are Car alarm, flashing light techniques which makes use of different type of sensors which can be pressure, tilt and shock & door sensors, but the drawbacks are cost and it only prevents the vehicles from theft but can't be used to trace the thief. Traditional car security systems rely on many sensors. When firstly 'Car Alarm System' is introduced, this system consists of mostly electromechanical devices. As technology advanced they evolved into fully integrated microprocessor based system using multiple electronics sensors.

In [2], the hardware and software of the GPS and GSM network were developed. The proposed GPS/GSM based System has the two parts, first is a mobile unit and another is controlling station. The system processes, interfaces, connections, data transmission and reception of data among the mobile unit and control stations are working successfully. These results are compatible with GPS technologies.

In [3], a vehicle tracking system is an electronic device, installed in a vehicle to enable the owner or a third party to track the vehicle's place. This proposed to design a vehicle tracking system that works using GPS and GSM technology. This system built based on embedded system, used for tracking and positioning of any vehicle by using Global Positioning System (GPS) and Global system for mobile communication (GSM). This design will continuously watch a moving Vehicle and report the status of the Vehicle on demand.

So, finally 'The smart car security system using image processing' is introduced which can overcome the advantages of GSM and GPS based system. In this system we can able to recognize the face of the theft by the camera used in that circuit. This system introduces and describes the design of mobile controller car security system offering higher level of car security features with the information of the thieves. In 1997 B Webb introduce wheel and steering lock system, to prevent car from theft, but they are visible from outside the car and prevent the wheel from being turned more than a few degrees. [1].

Whereas some proposed systems include finger print detection system along with face detection. These security systems are complex, costly and cannot be implemented on two wheelers. Two wheeler vehicles offer very less space to install the security module and hence even area is one of the major constraints. The demand is to design a system that performs necessary function, simple to operate, reasonably priced and small enough to be placed under the seat of the vehicle.

System Flow Diagram

The developed system makes use of an embedded system based on GSM technology. This type of system uses camera to take the picture of the person. When we run the MATLAB program the camera will get automatically get started.
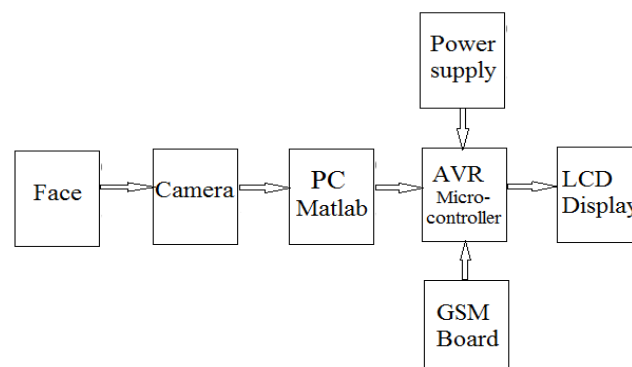

Fig: System flow Diagram

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Above figure show the basic flow of the system. In this firstly when we run the MATLAB program the camera will automatically get started. After camera start it will automatically take the picture of that person and within a second it will compare the capture image with the database image and show the message as "person recognized" when the capture image is match with the database image otherwise "no person found" message will display.

The block diagram of the this system is as i) Using GSM board we can send message to any mobile number which are stored into database. ii) By interfacing the GSM modem with PC containing MATLAB code. iii) GSM MODEM, PC, SIM, LCD (Liquid Crystal Display), microcontroller, power supply and also some connecting wires are the common peripherals required for developing GSM based applications

This MATLAB program is control by microcontroller which will activate the all part of the system. There is one LCD display is connected to the microcontroller. On which the message will display.

System Requirement

To develop this kind of embedded platform there will be two type of requirement is required.

Software Requirement

Hardware Requirement

Software requirement

MATLAB is image processing toolbox is used to locate the image that has been used. MATLAB is built around a programming language, and as such it's really designed with tool- building in mind. Guide extends MATLAB's support for rapid coding into the realm of building GUIs. GUIDE is MATLAB's Graphics User Interface (GUI) Design Environment GUIDE stores GUI's in two files, which are generated the first time you save or run the GUI:

-.fig file – contains a complete description of the GUI figure layout and the components of the GUI, changes to this file are made in the layout Editor.

-.m file – contains the code that controls the GUI, you can program the callback in this file using the M-file Editor

Hardware requirement

There are different hardware part are use to make this embedded system. These are explain as follows:

1) **Microcontroller**

Micro controller Based Circuitry is the BRAIN in our system. The microcontroller we have implied here is atmega16. The ATmega 16 is a low power CMOS 8-bit microcontroller based on the AVR enhanced RISC architecture. AVR is modified Harvard architecture 8 bit RISC single chip microcontroller which was develop by Atmel in1996. ATmega 16 is high performance low power Atmel AVR 8 bit microcontroller.

2) **LCD display**

A Liquid Crystal Display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals. Liquid crystal do not emit light directly. LCD are available to display arbitrary images or fixed image which ca be hidden or displayed, such as preset words, digits, and 7 segment displays as in a digital clock.

3) **Relay**

A relay is an electronic operated switch. It can be use only for on-off. Relays are used where it is necessary to control a circuit by low power signal or where several circuits must be control by one signal.

4) DTMF Decoder

DTMF is a 'Dual Tone Multi Frequency'. It receives the signal from mobile phone which is nothing but a audio signal. DTMF decode the receive signal and then generate 4 bit digital output which is then given to the microcontroller. It is an IC that take DTMF signal as input and decode it and shows the corresponding key as four bit output. The main features provide by this DTMF is it is low power consumption. It is mainly used in the remote data entry and credit card systems.

5) Buzzer

It sounds when the vibration sensor detect the vibrate signal on the car. A buzzer is an audio signal device, which may be automatically, electromechanical, or piezoelectric.

6) GSM module

Global System for Mobile communication (GSM) is a wireless modem that works with a GSM wireless network for mobile communication. GSM module in our proposed system is used for establishing the communication between the vehicle and the user**.**

7) GPS Receiver

The Global Positioning System (GPS) is a space-based satellite route framework that gives area and time data in all climate conditions, anyplace on or close to the Earth where there is an unhampered observable pathway to four or more GPS satellites.

III. Proposed Work

Basic MSLBP Algorithm

The local binary pattern operator is an image operator which transforms an image into an array or image of integer labels describing small-scale appearance of the image. These labels or their statistics, most commonly the histogram, are then used for further image analysis. The most widely used versions of the operator are designed for monochrome still images but it has been extended also for color (multi channel) images as well as videos and volumetric data.

The basic local binary pattern operator, introduced by Ojala et al. was based on the assumption that texture has locally two complementary aspects, a pattern and its strength. In that work, the LBP was proposed as a two-level version of the texture unit to describe the local textural patterns. The original version of the local binary pattern operator works in a 3×3 pixel block of an image. The pixels in this block are threshold by its center pixel value, multiplied by powers of two and then summed to obtain a label for the center pixel. As the neighborhood consists of 8 pixels, a total of $28 = 256$ different labels can be obtained depending on the relative gray values of the center and the pixels in the neighborhood. LBP using 8 pixels in a 3×3 pixel block, this generic formulation of the operator puts no limitations to the size of the neighborhood or to the number of sampling points.

Local Binary Patterns (LBP) is a type of feature used for classification in computer vision. LBP is the particular case of the Texture Spectrum model proposed in 1990. LBP was first described in 1994. It has since been found to be a powerful feature for texture classification; it has further been determined that when LBP is combined with the Histogram of oriented gradients (HOG) descriptor, it improves the detection performance considerably on some datasets.

Local binary pattern (LBP) is a nonparametric descriptor, which efficiently summarizes the local structures of images. In recent years, it has aroused increasing interest in many areas of image processing and computer vision and has shown its effectiveness in a number of applications, in particular for facial image analysis, including tasks as diverse as face detection, face recognition, facial expression analysis, and demographic classification.

As a typical application of the LBP approach, LBP-based facial image analysis is extensively reviewed, while its successful extensions, which deal with various tasks of facial image analysis, are also highlighted.

LBP-based facial image analysis has been one of the most popular and successful applications in recent years. Facial image analysis is an active research topic in computer vision, with a wide range of important applications, e.g., human–computer interaction, biometric identification, surveillance and security, and computer animation. LBP has been exploited for facial representation in different tasks, which include face detection, face recognition, facial expression analysis, demographic (gender, race, age, etc.) classification and other related applications. The development of LBP methodology can be well illustrated in facial image analysis, and most of its recent variations are proposed in this area.

The LBP feature vector, in its simplest form, is created in the following manner:

1) Divide the examined window into cells (e.g. 16x16 pixels for each cell).

2) For each pixel in a cell, compare the pixel to each of its 8 neighbors (on its left top,

left middle, left bottom, right top, etc.). Follow the pixels along a circle,

i.e. clockwise or counterclockwise.

3) Where the center pixel's value is greater than the neighbor's value, write "1".

Otherwise, write "0". This gives an 8digit binary number (which is usually converted to decimal for convenience).

4) Compute the histogram, over the cell, of the frequency of each "number" occurring (i.e., each combination of which pixels are smaller and which are greater than the center). Optionally normalize the histogram.

5) Concatenate (normalized) histograms of all cells. This gives the feature vector for the window.

In this system, a database of the employees, for example, of a firm, who are supposed to be given   entry   into   the concerned building, is prepared. Depending upon the method used, the type of database is prepared. For instance, in some cases we require a single photo of each person, while in some cases; photos in different conditions are required.

For each given pixel, a binary number is obtained by concatenating all these binary values in a clockwise direction, which starts from the one of its top-left neighbor. The corresponding decimal value of the generated binary number is then used for labeling the given pixel. The derived binary numbers are referred to be the LBPs or LBP codes. One limitation of the basic LBP operator is that its small 3×3 neighborhood cannot capture dominant features with large-scale structures. To deal with the texture at different scales, the operator was later generalized to use neighborhoods of different sizes. A local neighborhood is defined as a set of sampling points evenly spaced on a circle, which is centered at the pixel to be labeled, and the sampling points that do not fall within the pixels are interpolated using bilinear interpolation, thus allowing for any radius and any number of sampling points in the neighborhood.
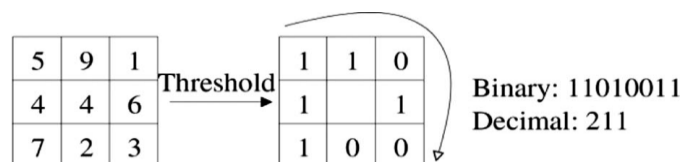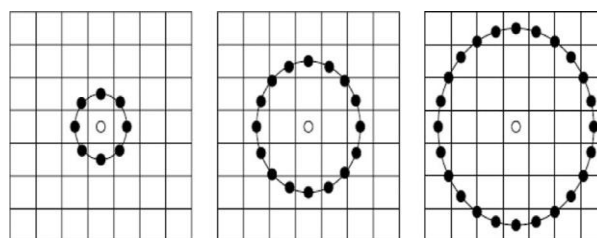

Fig: Example of the basic LBP operator

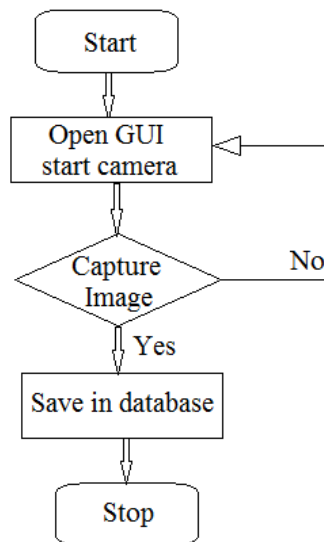Fig: The circular (8, 1), (16, 2), and (24, 3) neighborhoods.

Fig: GUI Input Image Flowchart explains briefly how our GUI processes the input image

A camera is kept at the main entrance, which takes the photo of the person trying to gain access to the building. The photograph needs to be taken properly to get proper result. This photo is then appropriately processed, according to the code based on a particular face recognition technique and then compared with each and every face in the database. The steps carried out and the time required for processing, as well as comparison, depends on the method employed. Different techniques employ different algorithms for the detection purposes. If the authorized person is present, his face gets detected and he is given entry into the building, while, an unauthorized person is denied entry.

The facial recognition is accomplished in a five step process-

Step 1 Acquiring the Image of an Individuals Face

 2 ways to acquire image

1) Digitally scan an existing photograph

2) Acquire a live picture of a subject

Step 2 Locate Image of Face

 MATLAB (image processing toolbox)is used to locate the image that has been used.

 Step 3 Analysis of Facial Image

Software measures face according to is peaks and valleys (nodal points) -nodal points are used to make a face print

Step 4 Comparison

The face print created by the software is compared to all face prints the system has stored in its database.

Step 5 Match Or No Match

Software decides whether or not any comparisons from step 4 are close enough to declare a possible match

IV. RESULT AND DISCUSSION

The prototype was an enhancement and development of the Anti Theft System concept to attain the economical environment for security, maintenance and productivity basis. The prototype has a GPS to track and locate position of the car. The input automatically sends warning message to the owner when an intruder was detected. Automatically the system informs the owner and block the possible car napped of the vehicle. The maintenance form of the program allows the car owner to track,

locate and view the current changes within the car. Monitoring the whole area inside the car will check for intruders attempting to steal.

The software design was constructed and developed to introduce the car owner with a new system that allows tracking and determining the location of the car. It also allows the car owner to use an android phone for detecting an intruder in the vehicle. Updating the location of the car is also one of the features of the software. The software was made in MATLAB with embedded C programming. This MATLAB is basically used for the face recognition or detection technique. In this software, the GPS receiver was interfaced to car to know the location of the vehicle.

The output is to satisfy the user's needs and to monitor for intruders. The design project was made in a purpose to change the common Anti Car Theft System. Technology makes ways for security to tighten its system to be more reliable and efficient to a car system.
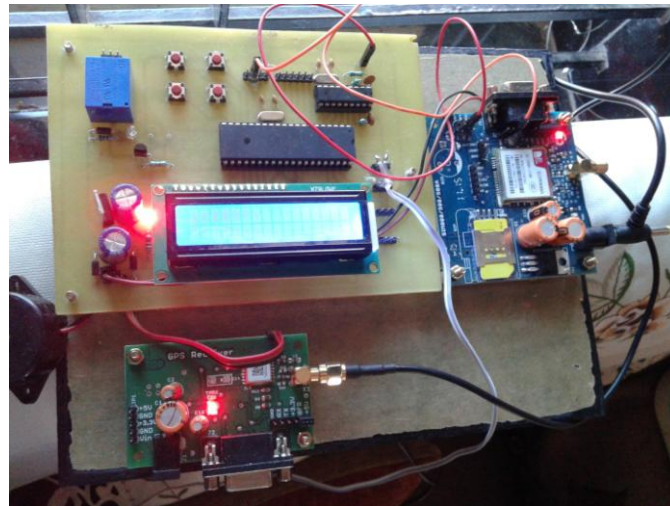

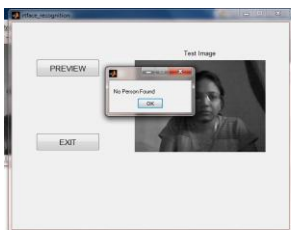Fig: Integrated System

Experimental Results

Command window

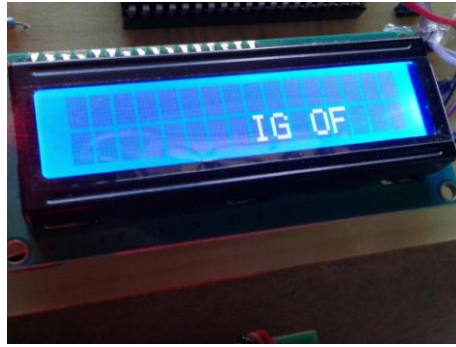Fig: First Test Image

Fig : Second Test Image

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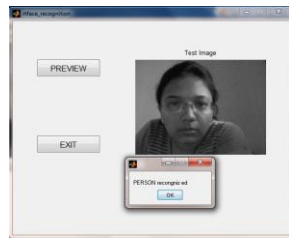
Fig : Output Display On LCD Display

Fig : Third Test Image

Fig: Output on LCD
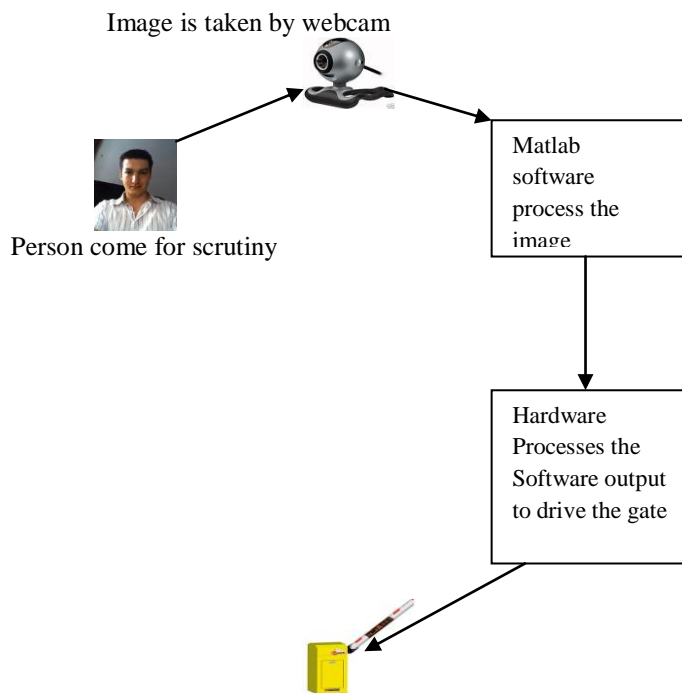

Fig: Pictorial Representation of the System

APPLICATION

1. Identification solutions:

With regards to primary identification documents, (Passports, Driver's licenses, and ID Cards), the use of face recognition for identification programs has several advantages over other biometric technologies.

2. Homeland defense:

This includes everything from preventing terrorists from boarding aircraft, to protecting critical infrastructure from attack or tampering (e.g. dams, bridges, water reservoirs, energy plants, etc.), to the identification of known terrorists.

3. Airport security:

Airport and other transportation terminal security is not a new thing. People have long had to pass through metal detectors before they boarded a plane, been subject to questioning by security personnel, and restricted from entering "secure" areas. What has changed, is the vigilance in which these security efforts are being applied.

4. Financial services:

The financial services industry revolves around the concept of security. Yet for the most part, security within the industry is limited to a simple personal identification number (PIN) or password.

V. CONCLUSION

Face recognition is a both challenging and important recognition technique. Among all the biometric techniques, face recognition approach possesses one great advantage, which is its user-friendliness.

This paper proposes the image recognition techniques that can provide the important functions by advanced intelligent automobile security, to avoid vehicle theft and protect the use of unauthenticated users. Secured and safety environment system for automobile users and also key points for the investigators can easily find out the hijacked image. From this we can predict the theft by using this in our daily life. This system mainly helps to reduce the complexity and improve security, also much cheaper and smarter than traditional one's.

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