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USE OF AUTOMOTIVE SECURITY SYSTEM IN REAL TIME DECLINE OF CAR THEFT

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Abstract: Now a day's automotive theft has been a persisting problem around the world and greater challenge comes from professional thieves by using strong stealing techniques. Modern security can be deactivated by professional thieves easily therefore we need a biometric authentication technology arises in automotive vehicles which will be working as Real Time systems. In this paper proposes an intelligent anti-theft car security system, which uses biometric application like Face Detection and Face Recognition to identify thief along with GPS module which tracks and locates the car. So access for the driving of the car will be for authentic person only and this will be done by the system which automatically takes photos of driver and compares his or her face with database to check whether he is an authenticated driver or not. If he/she is not an authenticated driver access to the vehicle will not be provided. Also, the owner of the vehicle gets an image of the theft via MMS (Multimedia Messaging Services) and exact location via GPS module which is an additional feature of the given system.

Keywords: Real Time systems, Face Recognition, Face Detection, GPS (Global Positioning System), MMS (Multimedia Messaging Service).

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INTRODUCTION

As the demand for the cars is increasing day by day there has also been increased in the car theft cases by using latest technology. According to National Crime Records Bureau (NCRB) auto theft in the country is increasing day by day because of such circumstances automobile manufacturers are more focusing on anti theft technologies which could prevent loss of car and identify the victim responsible for theft [1]. Currently, automobile manufacturers use computer chips and other common security methods to ensure that even complete copy of the original vehicle mechanical keys, can only open the door, but cannot start the vehicle. However, there is a variety of vehicles decoder on the market, and the thieves can use the decoder to replicate the electronic chip keys, which can start the vehicle, in just a few minutes. Such as the decoder, which used the latest intelligence decoder chip developed by the United States, can unlock the most electronic locks of Mercedes Benz, BMW, Audi, Ferrari and other high-end models. Thus, it will be the sticking point of vehicle alarm to lock or unlock engine, through authenticating the identity legality.

There are different biometric technologies which are unique and invariant for a very long time, such as fingerprint, iris, palm vein, hand vein, finger vein, face, knuckle creases, hand-type and so on which all can be used as the basis of authentication and the various biological characteristic have their own advantages and disadvantages. 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. It doesn't require physical interaction.
4. It allows passive identification.
5. It doesn't require expert to interpret the comparison.

Thus, we have chosen Face Recognition as a biometric technology for security purpose [7].

A. Existing Methods

In existing method some changes are done with working flow like commends to off ignition or to control ECU unit are send through mobile but in some case like during night owner might not get woke up or if he is deep sleep he never know when mms or sms have came so he can't send

command also the cost of such system is much higher than proposed system and power consumption is also too much [7]. So by considering these problems in existing system some changes in working flow is done and focused more on face detection and reorganization techniques [9].

II. PROPOSED METHODS

The implementation of automotive security system was done by making use of Advance RISC (Reduced Instruction Set Computing) Machine (ARM)[9]. The block diagram for the hardware is shown below fig 1.0. Proposed anti-theft smart car security system that prevents car from loss uses Biometric application like Face Recognition, GPS module for tracking the location of car and MMS module for user identification. A hidden webcam is placed in the car, in which the video frames will be recoded and face of the person trying to enter the car will be recognized using face recognition and detection system [4]. As soon as the person sit the sensor beneath the seat will be get activated and the signal will be get send to ARM7 processor then the processor will activate hidden camera and then image/images captured by camera will be sent to image processing application on PC. Then the exact process will start for the recognition of person whether he is authentic or not by cross checking it with the stored images of authorized driver in data base. If the person is authorized then no work will be done that person can start the car and if he is not authorized, the ARM7 will disable the access to vehicle by disconnecting the battery connections and ignition unit [3]. The GPS module finds the exact location of the vehicle to the owner's registered mobile. Also, the MMS modem will send the snap of theft on the same. The basic block diagram is shown below in Fig 1.

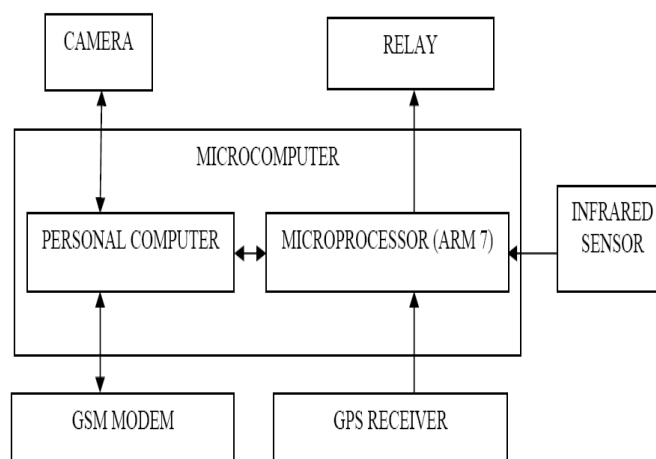


Fig 1:-Basic Block Diagram

And the whole working of the system from initial to final state as explained in proposed method is shown below fig2.

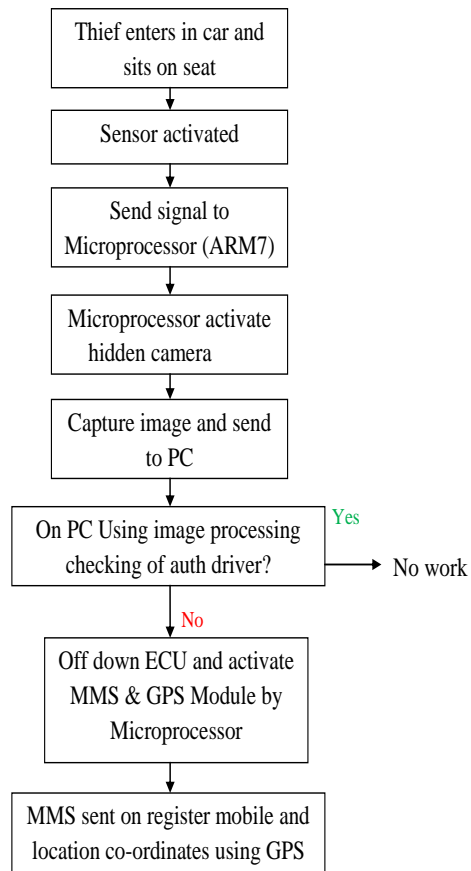


Fig 2: - Proposed method working flow chart

A. METHODOLOGY

The microcomputer which contains the image processing unit embedded within it performs the face detection and authorizes the person. The processing of image involves two parts, face detection and face recognition as shown below.

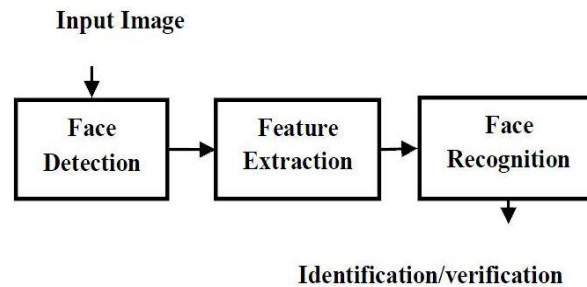


Fig 3. A generic face recognition system

1. Face Detection: -It is a fundamental part of the face recognition system. Face detection involves the separation of image into two parts; one containing the face and the other containing the background i.e. separation of foreground part from the background. And the process of face detection used for the system presented in this paper is robust and rapid. Face detection algorithm extracts face portion alone from the photo taken by a webcam. At first, we get the location of the eye pair easily due to brighter pupil effect. After the location of eye pair, we can easily clip the face area from the input image according the spatial relationships between eye pair and face. It is difficult because although commonalities exist between faces, they can vary considerably in terms of age, skin color and facial expression [2]. The acquired image is processed to detect the face using the Viola Jones algorithm (Viola and Jones, 2001). The Viola–Jones object detection framework is the first object detection framework to provide competitive object detection rates in real-time proposed in 2001 by Paul Viola and Michael Jones which effectively uses the cascade object detection [6]. The cascade detector detects the face of the acquired image and the face region is extracted. The authentication based security system has the database which stores the face images of the authorized drivers face under different environments. The face images are enhanced by normalizing them to remove the unwanted information due to illumination constraints while acquiring the image and are stored in the database. Now the task of face recognition must be performed with the detected faces [7].Also the Viola–Jones object detection framework is having advantages and disadvantages listed below

1. Advantages:

- It is the most admired algorithms for face detection in real time.
- The main advantage of this approach is uncompetitive detection speed while relatively high detection accuracy, comparable to much slower algorithms.

- High accuracy. Viola Jones gives accurate face detection.
- Constructing a cascade of classifiers which totally reduces computation time while improving detection accuracy.
- The Viola and Jones technique for face detection is an especially successful method as it has a very low false positive rate.

2. Disadvantages:

- Extremely long training time.
- Limited head poses.
- Not detect black Faces [10].

Different techniques are also present shown in table below with their pros and cons

Face Detection Techniques	Merits	Demerits
Feature base Face Detection	- More accurate - Low execution time	- High learning Time
Geometric Base Face Detection	- Effective approach - Easy to implementation	- Low accuracy - More false Alarm
Haar Like Feature Base Face Detection	-Improved feature extraction part - Less false alarm	- High execution time - Complex to Implement

Table1. Pros & Cons of Several Existing Methods

2. Face Recognition: -

Basically face recognition is used for two primary tasks:

1. Verification (one-to-one matching): When presented with a face image of an unknown individual along with a claim of identity, ascertaining whether the individual is who he/she claims to be.
2. Identification (one-to-many matching): Given an image of an unknown individual, determining that person’s identity by comparing (possibly after encoding) that image with a database of (possibly encoded) images of known individuals.

In face recognition, validation of the input image is done .i.e. it involves comparing the input face with the faces in the database. Photos in the database is called training images and the photo taken during authentication phase is called as test image. Human face recognition belongs to a general classification problem with the characteristics limited spanning space.

There are numerous application areas in which face recognition can be exploited for these two purposes, a few of which are outlined below.

- Security (access control to buildings, airports/seaports, ATM machines and border checkpoints [2, 3]; computer/network security [4]; email authentication on multimedia workstations).
- Surveillance (a large number of CCTVs can be monitored to look for known criminals, drug offenders, etc. and authorities can be notified when one is located).
- General identity verification (electoral registration, banking, electronic commerce, identifying newborns, national IDs, passports, drivers' licenses, employee IDs).
- Criminal justice systems (mug-shot/booking systems, post-event analysis, forensics).
- Image database investigations (searching image databases of licensed drivers, benefit recipients, missing children, immigrants and police bookings).
- "Smart Card" applications (in lieu of maintaining a database of facial images, the face-print can be stored in a smart card, bar code or magnetic stripe, authentication of which is performed by matching the live image and the stored template) [7].
- Multi-media environments with adaptive human computer interfaces [8, 9].
- Video indexing (labeling faces in video).
- Witness faces reconstruction.

We have different approaches for face recognition as Hidden Markov Models (HMM), Neural Networks (NN), Support Vector Machines (SVM), and Principal Component Analysis (PCA) [3]. We give a comparison over the above methods in the Table2.

Face Recognition Approaches	Accuracy
PCA	98.50%
HMM	84.00%
Neural Network	95.60%

Table2. Comparison of different Face Recognition approaches

We can conclude from it that the PCA Eigen faces algorithm can give a high accuracy. Again it costs less time than the other two algorithms that is very important in real time embedded applications. In our embedded automotive security system, the PCA Eigen faces algorithm is used for driver's real time face recognition. [8]

2.1 Principal Component Analysis (PCA)

The purpose of PCA is to reduce the large dimensionality of the data space to the smaller intrinsic dimensionality of feature space, which is needed to describe the data economically. The main idea of using PCA for face recognition is to express the large 1D vector of pixels constructed from 2D facial image into the compact principal components of the feature space. This can be called Eigenface Projection.

The key working point is the test image is to be compared with the database images and the classifier used in the algorithm decides the image as known or unknown using the Euclidean distance and the threshold value. Here test image means the real time image captured through hidden camera of driver.

The Euclidean distance is calculated by between the corresponding weights of features and the image which produces minimum distance is best matched with the test image. If the Euclidean distance is smaller than the threshold value then the person is classified as known or authorized and when the distance value exceeds the threshold then the person is unknown or unauthorized [8].

The flow chart is shown below Fig.4

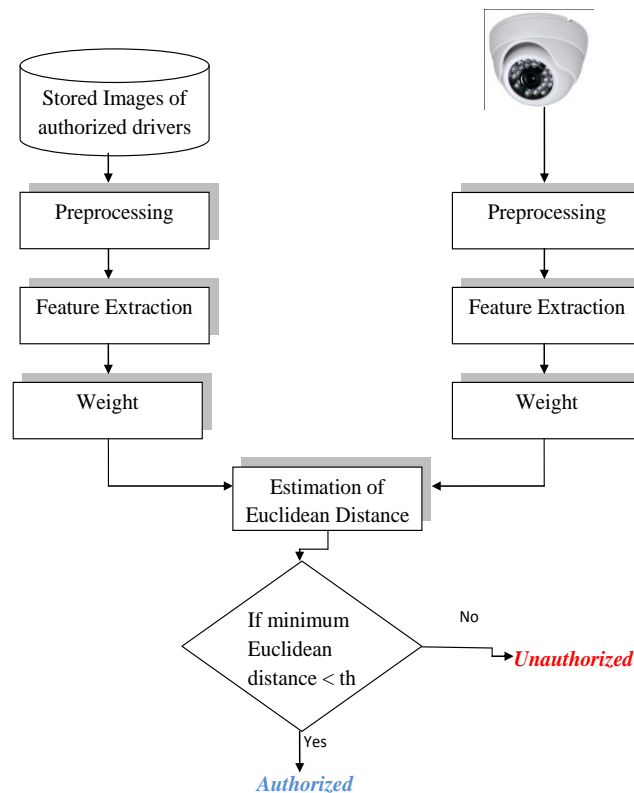


Fig.4 Face reorganization and matching technique work flow

As shown in work flow chart after preprocessing the feature extraction is done following the weight i.e. Eigen Weight calculation from that Euclidean Distance is being calculated and that will be compare with threshold and this will be deciding point that whether the person sitting on driver seat is authorized or not.

The whole process is done on MATLAB 7.10.00 as a platform in PC shown in fig 1.

3. Embedded Module

Control on vehicle will be done using this module as it is the heart of the system. All processes are controlled by embedded control central module ARM7 that includes Face Detection, GPS, SMS and ECU (Engine Control Unit). As soon as the unauthorized face is detected the image of that person is sent to the owner's registered mobile number via MMS module. A GPS Module is used for parsing the strings, Latitude and Longitudinal information of the car. The advance RISC machine is used which require very less power consumption and low cost. ECU unit is made for

the control on combustion unit and battery supply. And ARM7 will be responsible for ON/OFF of the ECU unit [1].

III. CONCLUSION

In this paper, an embedded automotive security system which involves face reorganization is presented. This system can be used in reducing car theft and also this system is less costly as it is not having much sensor's. This face reorganization technique can be used other areas also like ATM, Robotic, Verification domain etc.

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