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Vehicle Theft Detection through Face Recognition and Accident Alert & Locator System

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ABSTRACT
In today's era the use of vehicle is must for everyone. At the same time, the ratio of vehicle theft increasing day by day rapidly. Due to this, the protection of vehicles from theft is also very important. Prevention of automobiles from theft can be done by using authorization for the owners and by building anti-theft system in vehicles. In this proposed security system face recognition is used for identifying the authorized person and the comparison is done through the preloaded faces for authorization. The vehicle will start only when the authorized person's face is recognized by the system. If the unauthorized person or theft attempts to drive the vehicle, an SMS/MMS will be sent to the owner along with the current location of the vehicle using GSM/GPS modem. For face recognition, a Principal Component Analysis (PCA) algorithm is developed in Java. The current location of the vehicle will be found through GPS and GSM modem controlled by FPGA. In case of automobile crash, the crash detector sends an activating signal to the GPS/GSM module, this module is programmed to fetch from the memory, personalized plate number of the particular vehicle involved; coupled with the GPS information.

Index Terms— PCA, FPGA, GSM, GPS, MMS

I. INTRODUCTION

Now a day's everywhere in the world automobile theft is increasing day by day. The automobile manufacturers are attempting to improve the security features of their products by introducing advanced technologies to avoid the thefts particularly in the case of cars. Here, we are dealing with design and development of a real time face recognition system using FPGA as control platform. This security system can recognize the person who enters in the car and it will check whether he/she is authorized person or not. When an unauthorized person try to operate the car, the GPS and GSM modules which are attached with the security system sends the thefts or unauthorized person's image and current location of the vehicle through MMS/SMS to the owner of vehicle. The camera which is installed at the ignition unit of the vehicle will capture the image of the person and the security system compares the photo of that person with the photos of the authorized persons which are already present in the database in different postures, to check whether that person is authorized person or not.

The Principal Component Analysis (PCA) algorithm is used for face recognition with fixed white back ground. The PCA converts a number of possibly correlated variables into number of uncorrelated variables called Principal Components related to the original variables by using statistical methods.

When an automobile crash occurs suddenly, the emergency services become a race between the life and death. Now a day, wireless innovation has becomes in favor of success like never before. This proposed system details about accident of automobile emergency alert situation. In this proposed system we are trying to program a GPS / GSM module to fetch from the memory, personalized plate number of the particular vehicle involved; coupled with the GPS information (i.e. latitude, longitude, speed etc.). An SMS is sent to a communication database server and the server sends this SMS to the appropriate agencies such as nearest FRSC, Police Station, Medical Centres etc. for immediate deployment of paramedic officials as well as all emergency units within the vicinity of the crash. This can provide early response and rescue of accident victims; saving properties and lives**.**

II. PROPOSED SYSTEM DESCRIPTION

THE PROPOSED SYSTEM IS DIVIDED INTO TWO PARTS:

1) Face recognition and detection (PCA):

There are already many algorithms used in face recognition and detection, and many more have being developed. But PCA is the best and mostly used algorithm for face recognition. PCA is used for compression and to overcome many of the recognition queries like pose variations, illumination etc. The Linear Discriminate Analysis (LDA), Independent Component analysis (ICA) and some other systems are developed by combining different algorithms. PCA is the simplest of the true eigenvector-based multivariate analyses that's why PCA is also known as "Eigen faces" algorithm. Eigen faces is the name given to a set of eigenvectors when they are used in the computer vision problem of human face recognition. In designing a system for automated face recognition using Eigen faces, they showed a way of calculating the eigenvectors of a covariance matrix in such a way as to make it possible for computers at that time to perform Eigen-decomposition on a large number of face images.

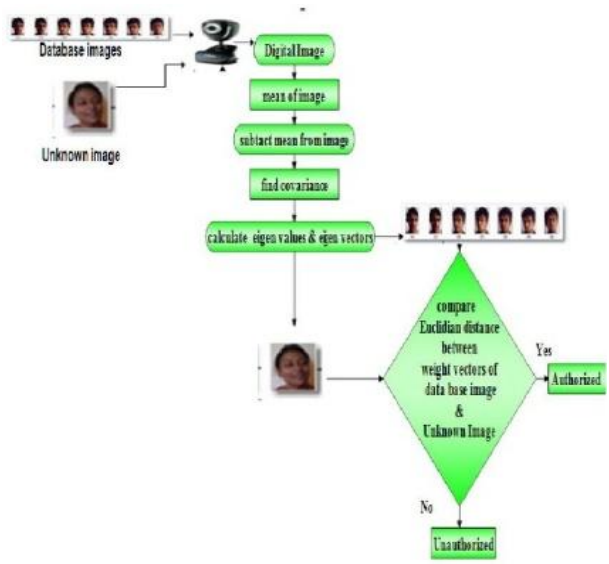

Fig 1. The PCA Algorithm

1.1. Steps of PCA Algorithm:

1) Get database set of images and then find mean of the images.
2) Find the difference between mean image and each of database images.
3) Find covariance matrix of the matrix obtained from step 2 for this covariance matrix.
4) Find Eigen values and Eigen vectors, and then find Eigen faces with larger Eigen values.
5) Find out weight vector using this Eigen faces.
6) For new/unknown image also the process will be echoed from step 1to3 and then find out weight vector for test image.
7) Now find Euclidian distance between weight vectors of unknown image and database images.
8) If this distance is less than threshold then test image is considered to be in database and hence authorized, otherwise unauthorized.

1.2. Benefits of PCA Algorithm:

- PCA is used to reduce the dimension of image.
- The complexity of grouping image can be reduced with PCA.
- PCA can also be beneficial for criminal Investigation.
- As components are orthogonal, no data redundancy.
- PCA can also be beneficial for access control for computers and laptops, entrance control in offices and banks, for passport verification, for Automated Teller Machine (ATM).

1.3. Features of PCA:

- PCA calculates the empirical mean, derivations from mean, covariance matrix, eigenvectors and eigenvalues of the covariance matrix and correlations of large data sets.
- PCA ranks and calculates the principal components and their variances.
- PCA can organize and analyse the data sets up to 200 columns and 50,000 rows.

1.4. Field Programmable Gate Array (FPGA):

Due to programmable nature FPGA is used for multipurpose applications while other platforms like DSP processors, microprocessors and microcontrollers are application specific. An FPGA embedded processor system offers many exceptional advantages compared to typical microprocessors including high performance, component and cost reduction, hardware acceleration, obsolescence mitigation, reliability and long term maintenance. In FPGA interface with video processing, image processing, communication applications and embedded module facilities are available. For implementing DSP applications FPGA will be the preferred choice. For many real-time applications the programmable devices like SPATRAN 3E FPGA become the best option. When compared with Altera, Lattice and Actel products the Xilinx software is most useful. In our proposed system Xilinx 10.1 VHDL language is used.

1.5. Global Positioning System (GPS) Module:

The Global Positioning System (GPS) is used to find the current location of the vehicle. The two main categories of GPS vehicle tracking systems are real time systems and passive systems. The real time system sends the information at regular intervals to the database and the user of the system can read it. Passive systems store the gathered information in their internal memory and it can be accessed when the unit is connected to the database. Other systems can deliver data directly to the user's cell phone on-demand.

1.6. 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**.** The multimedia messaging service (MMS) is used for sending all the messages. Java 1.6 is used to code the module for transferring pictures through the GSM network. GSM modem is used to send MMS.

2) Vehicle Accident Alert and Locator System:

When automobile crash, the crash detector sends an activating signal to the GPS/GSM module, this module is programmed to fetch from the memory, personalized plate number of the particular vehicle involved; coupled with the GPS information (i.e. latitude, longitude, speed etc.). An SMS message is sent to a communication database server (CDS) (signals2,3). The CDS automatically compares the information received (plate number in this case) with the mapped information in the memory.

The communication database server fetches the above information alongside the GPS data received(signal 4) and send them to the appropriate agencies such as nearest FRSC, Police Station, Medical Centres etc. (signal 5) for immediate deployment of paramedic officials as well as all emergency units within the vicinity of the crash.

The road officials could communicate with the vehicle (signal 6) to find out the exact physical situation of the event, if there are persons in the vehicle to respond accurately to these questions, (signal 7), the paramedic with the FRSC informs the nearest hospital or medical centres of the extent of medical attention needed by the victims(signal 8). All information from sectoral database are sent to a centralized database for backup (signal 9).

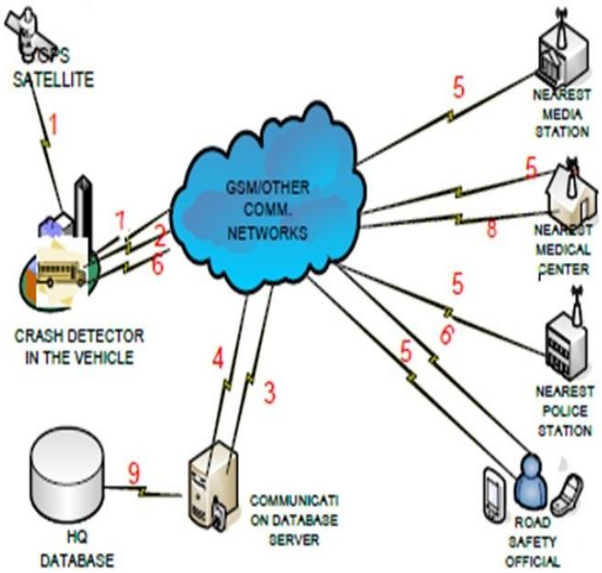

Fig 2. Working of Crash Detector System

III. EXPERIMENTAL RESULTS

As the proposed system is a combination of different modules, so each module has been checked individually and the results are as shown below.

Fig.3 Login Page

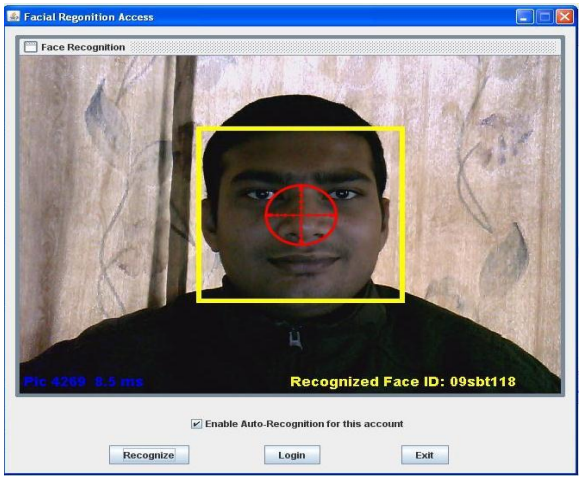

Fig.4 Face recognition and Id generation

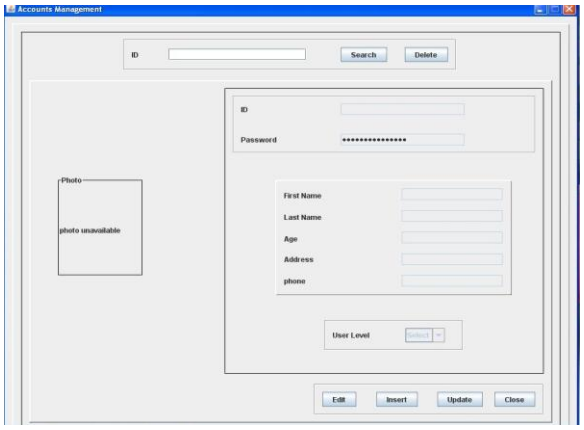

Fig.5 Account management

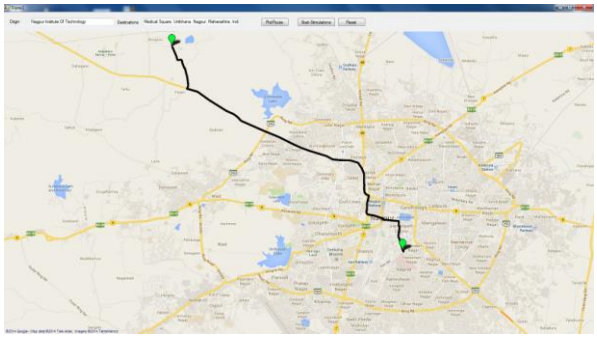
Fig.6 Plotting of Route

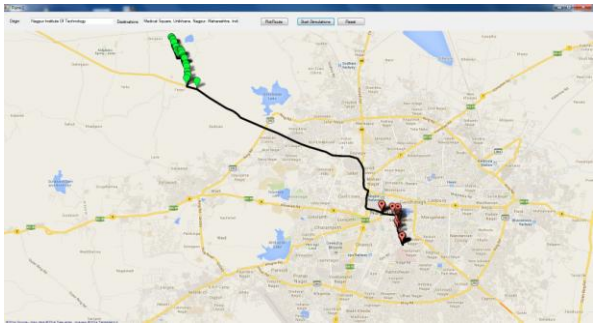
Fig.7 Stimulation of Vehicle running in routed path

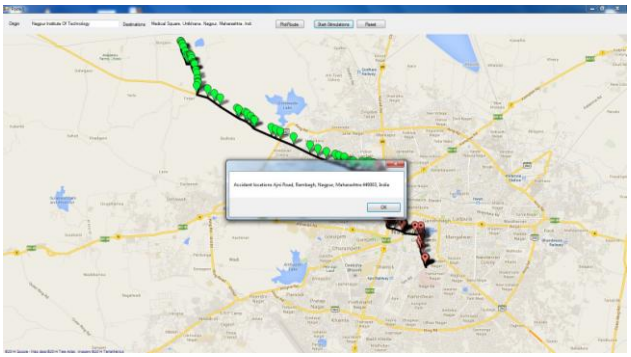
Fig.8 Accident location tracked by the system

IV. CONCLUSION

In this paper, a real time security system based on Global System for Mobile (GSM), Global Positioning system (GPS), FPGA and Vehicle Crash Detector is introduced. This security system is suitable for a real time monitoring in vehicles, controlling and avoiding the theft with face recognition and detection. It will also help to locate the Accident & when the accident occurs then crash detector sends an activating signal to the GPS/GSM module. In this proposed system, GSM/GPS has been used for sending MMS/SMS and knowing current location of the vehicle. Similarly when accident occurs SMS is being sent to the nearest agencies such as police posts, hospitals, fire services etc., giving the exact position of the point where the crash had occurred.With the adoption of standards and community awareness, this technology will become more and more acceptable to avoid and control vehicle theft.

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