Real-Time Interface of Smart Robot Design with user Identification Application

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Abstract: **A Robotic vehicle is allowed to move in the restricted area and the presence of human can be detected using pyroelectric infrared sensor. In order to check whether the person is recognized or not, face recognition has been done. Face recognition has a great impact in security measures and it has been using in many areas widely. To execute face recognition, mathematical calculations have been adopt to develop routine recognition systems. As the face recognition system has to perform over wide range of database, dimension reduction techniques become a prime requirement to reduce time and increase accuracy. Here, face recognition is done using Principal Component Analysis followed by Linear Discriminant Analysis. The next steps are done in this paper- preprocessing, dimension reduction of training database set by PCA, extraction of features for class separability by LDA and finally testing by nearest mean classification techniques. The transfer of message is done through GSM and the further action for security purpose happens.**

Keywords: Robotic Vehicle, PIR Sensor, Face Recognition, PCA, LDA and GSM.

I. INTRODUCTION

In military applications for penetrating terrorists in forest and to detect the presence of human motion in the restricted areas, PIR (pyroelectric infra red) sensor is used. Earlier days, the presence of human beings was detected using some devices like video camera, radar, ultrasonic sensor etc. In case of video camera another human have to continuously monitor the video. If we use radar or ultrasonic sensor, we need a transmitter and a receiver. In case of PIR sensor, it absorbs the infrared radiation (wave length of 9.4 micro meters) from the human body and creates a corresponding signal. As this is sensitive only to human body heat and frequency of radiation, this sensor can be used to find human up to 3 to 90 meter distance. Thus it helps to find the presence of human beyond the barriers like walls and fire etc. A robotic vehicle is made to move in a particular track of restricted areas. The control of the robotic vehicle is made from anywhere since it is maintained through mobile service. Once the presence of human motion is detected, a warning indication will be send to the controller through GSM[1]. The video will be captured continuously from which the image of the person in the restricted area will be segmented and the recognition of face is done. Recognition of face plays the major role here.

The identification of objects in an image. This process would probably start with image processing techniques such as noise removal followed by feature extraction to locate lines, regions and possibly areas with certain textures. The clever bit is to interpret collections of these shapes as single objects. One reason is an AI problem is that an object can appear very different when viewed from different angles or under different lighting. Another problem is deciding what feature belongs to what object and which background or shadows. The human visual system performs these tasks mostly unconsciously but a computer requires skillful programming and lots of processing power to approach human performance. A biometrics system based on face recognition has a very large number of applications like security systems, identification of criminals, image and movie processing, man-made interaction. Unfortunately, the development of computational models for the face recognition is a very difficult task as we still do not know how the brain of human recognizes the face. The automatic face recognition involves the resolution of some complex problems like face localization in complex scenes, invariance to pose and enlightenment, invariance to change in expression and invariance to moustache, beard, glasses, style.

II. DESCRIPTION

A.PIR SENSOR

Every object has a temperature above perfect zero emits thermal energy (heat) in the form of radiation. We the human being radiates at the wavelength 9-10micrometer all time of the day.PIR are tuned to detect the IR wavelength, which only emanates when a human being arrives in the proximity. The PIR sensor itself has two slots in it, each slot is made of a special material that is sensitive to infra red. The lens using here is not really doing much and so we see that the two slots can see out past some distance[2]. When the sensor is idle, both slots detect the same amount of IR., the ambient amount radiated from the room or wall or outdoors. When a

warm body like human or animal passed by , it first intercepts one half of PIR sensor, which caused a positive differential change between the two halves, when the warm body leaves the sensing area, the reverse happens, whereby the sensor generates a negative differential change pulse what is detected. Researchers have been working on detecting movement direction and counting people entering or leaving the entrance of the room or building using the on-off output signal of PIR sensor[3]. They presented a people counting system composed of a one-dimensional eight element custom- fabricated array detector, an IR transparent lens and an oscillating mechanical chopper. They simply differentiate the direction of movement at a gateway by observing the time difference between inward-facing and outward-facing PIR sensor.

B.PIC 16F877A

It is programmable interface controller. This is programmed using the software Microcode Studio. The needed pins are taken as input and outputs. This microcontroller is a 40-pin 8 bit CMOS FLASH microcontroller for microchip. The core architecture is high-performance RISC CPU with only 35 single word instructions. Since it follows the RISC architecture, all single instruction take only one instruction cycle except for program branches which takes two cycle. This comes with three operating speed 4, 8 or 20MHz clock input. Since each instruction cycles takes four operating clock cycles, each instruction takes 0.2us when 20MHz is used. The input for the microcontroller is PIR sensor signal. As this microcontroller has interrupt functions, it is able to find number of humans in any room.

C.GSM (GLOBAL SYSTEM FOR MOBILE COMMUNICATION)

It is a digital mobile telephony system that is widely used in Europe and other parts of the world. GSM is a TDMA based wireless network technology. GSM phones make use of SIM card to identify the user account. It defines number of network database that are used in performing the functions of mobility management and call control in a public land mobile network[4]. These elements includes the location registers consisting of the home location registers (HLR), and the visiting location registers (VLR), the equipment identity register(EIR), and the authentication centre(AC). The HLR maintains and updates the mobile subscribers location and his or her service profile information.

D.MECHANICAL DESIGN

In this car we use two 12V dc motors for their motion. These motors are fixed with back wheels each with one. Front wheel is free to rotate. Let's see the actions for the car.

1. FORWARD

In this motion both the motors are rotate to move the car forward direction.

2. BACKWARD

In this motion both the motors are rotate to move the car in backward direction.

3. TURN LEFT

In this motion right motor is moved toward forward and left motor is moved towards backward.

4. TURN RIGHT

In this motion left motor is moved toward forward and right motor is moved towards backward.

5. SEARCH& RESULT

Using a DC motor the robotic vehicle will be moved in the path and the identification of human will be done. The transfer of message will be done using GSM

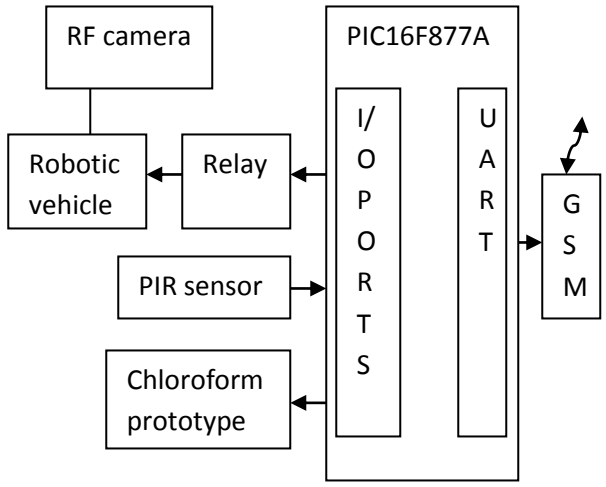


Fig.1. Design of Robotic Vehicle Setup

III.FEATURE EXTRACTION AND CLASSIFICATION TECNIQUE

A. Facial recognition

It is a form of computer application used for automatic verifying or identifying a person from a digital image source[5]. By comparing the testing image from the trained set of database and this is done either by verification or identification.

Identification- The system compares the given individual to all other individuals in the database and gives a ranked list of matches.

Verification- The system compares the given individual with who that individual says they are.

The block diagram for face recognition has been shown in fig 2 in which the feature extraction and the classification technique has been done for all the trained images and the values are stored in the database then for the testing image the same process is done and the image with nearby cross threshold value will is be made into consideration and the further process either recognized or not is analyzed.

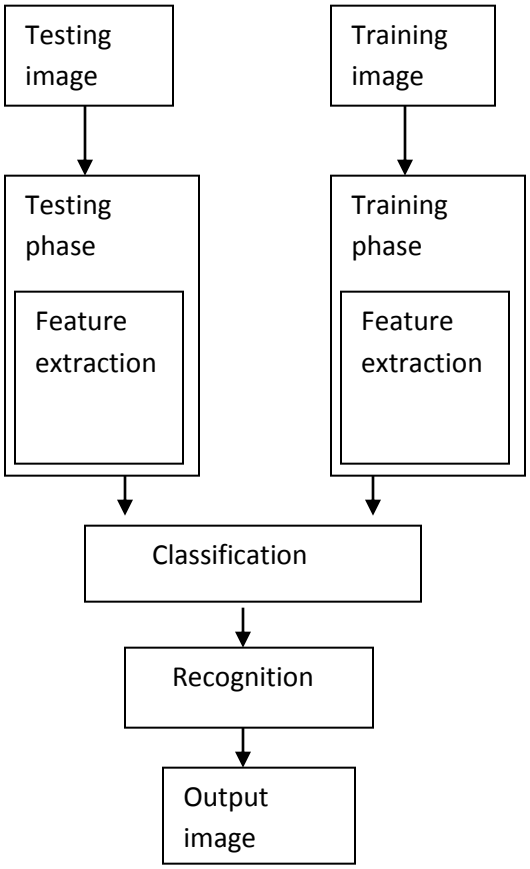


Fig.2. Face Recognition- Block Diagram

Using PCA-LDA method the recognition rate can be increased and the computational cost can be reduced.

PCA and LDA

PCA is a linear dimension-reduction technique. It aims to find the project directions along which the reconstructing error to the original data is minimum, and projects the original data into a lower dimensional space spanned by those directions corresponding to the top Eigen values[6]. In face recognition, those directions which are the eigenvectors of the covariance matrix of face images are orthogonal basis vectors. One of the most used and cited statistical method is the Principal Component Analysis (PCA). It is a mathematical procedure that performs a dimensionality reduction by extracting the principal components of the multi-dimensional data. PCA, LDA tries to model the differences between classes[7]. Classic LDA is designed to take into account only two classes. Specifically, it requires data points for different classes to be far from each other, while point from the same classes are close.

IV.PCA FOLLOWED LDA METHOD

As PCA performs better than LDA when number of samples per class is small & dimension of face image is large. However performance of LDA better when database is very large and having different class datasets. To take advantages of both of these techniques, they are combined. Flowchart of the proposed algorithm is being shown in fig 3. Here PCA performs dimension reduction by projecting the data onto the Eigen face space upon which application of LDA performs class separability by classifying the Eigen face space projected data.

The method consists of four stages:

a. Preprocessing
b. Dimensionality reduction of images of Training Database by PCA
c. Facial feature extraction for class separability by LDA
d. Nearest mean classification

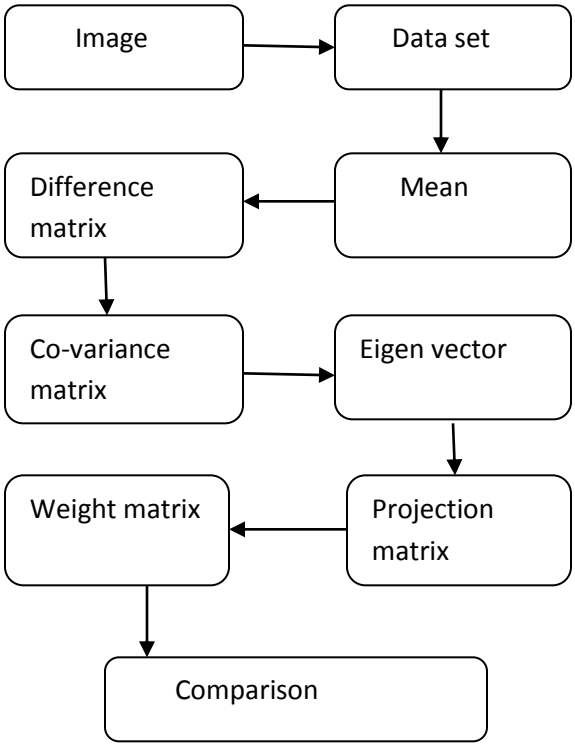
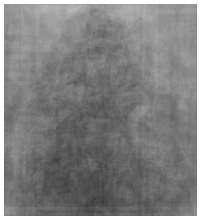


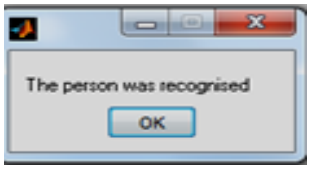
Fig.3. PCA-LDA Representation

Once the recognition of face is done using PCA-LDA method the required output will be obtained as follows

Simulation results for recognized face



The original image is converted in to grayscale using rgb2gray command. This makes processing much simpler since then there are only a third of the pixel values present in the new image. The gray converted image is then enhanced using histogram equalization. The enhancement technique is used to remove the unwanted noise thus the enhanced image will have much accuracy for further processing. Then this enhanced image is converted in to binary image. Edge detectors are very useful for locating objects within images. The Sobel edge detector is able to look for strong edges in the horizontal direction, vertical direction, or both directions[8]. Then the mean of the image is calculated.



The message will be displayed as recognized person.

Simulation results for unrecognized face

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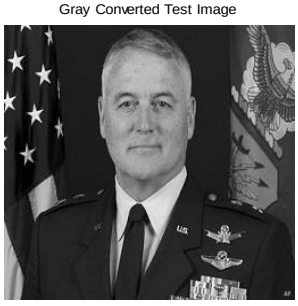
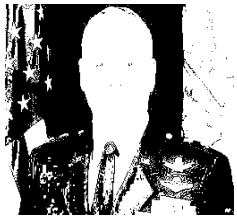
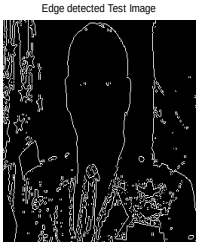
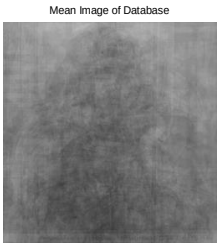


The original image is converted in to grayscale using rgb2gray command. This makes processing much simpler since then there are only a third of the pixel values present in the new image.



The gray converted image is then enhanced using histogram equalization. The enhancement technique is used to remove the unwanted noise thus the enhanced image will have much accuracy for further processing. Then this enhanced image is converted in to binary image.





Edge detectors are very useful for locating objects within images. The Sobel edge detector is able to look for strong edges in the horizontal direction, vertical direction, or both directions. Then the mean of the image is calculated.

Thus the image does not match with any of the images in the database hence the message will be displayed as unrecognized image.

V. CONCLUSION

Once the simulation result is transferred to the robotic vehicle through GSM the further action will be done. If the output is recognized no further action happens and for unrecognized person the action of chloroform prototype starts.

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