DESIGN AND IMPLEMENT ADVANCE SECURITY SYSTEM BY USING ADVANCE PCA ALGORITHM

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Abstract:- It is said that "A word is more powerful than a letter but an image is more powerful and sound than thousand words". That means an image is stronger than a bunch of words but creating an image is not simple as it looks. The image is passes through many processes that constitute to create an image through image processing. The image processing is the process that constitutes processes varying from image capturarion to image representation. The image taken is then processed, segmented, restored, etc. this is about digital image processing. for that purpose we need the image processing algorithms which are classified on the basis of their use such as face recognition or feature extracting, etc. In today's time we have the algorithm which works in both areas such as Haar, Eigen faces, fisher faces, PCA, viola- jones, LBPS, etc., but even for better result as these algorithm suffers from some drawbacks, we need advance algorithm. For that purpose we use advance PCA algorithm which is the combination of PCA along with some feature of haar and Eigen faces as both were basic blocks of PCA. After simulating we find that this algorithm is very much useful for the face recognition and also provides the better result with the moderate-to-high varying efficiency. On that basis we have create the advance security system based on advance PCA algorithm which consists of Raspberry pi as a controller. The pi camera and image database are also the major part of this designed system. The efficiency for this designed system is much higher than other designed system in the same area. The impact of this system is that, it allows the direct interface of authorised user from remote place and also provides control by android application. The uses and its implications on the society is that this will become superior, flexible and optimized, reliable security system.

Keywords: **Advance PCA Algorithm, Raspberry Pi, Pi Camera, GSM Module, Database, Gmail, Android Application, Etc.**

INTRODUCTION

The word security reflects the safety whether it belongs to things or life. From the beginning of life human was in the search of security. As human progress, the security levels were also increases. Thus need of optimised, flexible, compact and reliable security system comes. The solution was comes in the form of face recognition system. The face recognition/detection security will provide the better result and with higher level of automation it gives the better numerous amount of security options.

Face detection based security systems evolution creates the optimized security system which restricts the entry of unknown and provide security. There are many new technical instruments like door intercoms but the security was still the question of matter as it is not that much compact and have no storage. So to improve the existing security and reduce the risks, the security system based on advance PCA was designed which is combination of PCA along with haar and eigenfaces.

The face detection/recognition system usually works on the higher controlling instruments such as Raspberry Pi which provide the interface of system to the outer world. The images are taken by camera and stored and processed with database. The result of process will decide the entry for the intruder.

The basic work structure of our face detection system is: - The camera captures the image. After this, using advance PCA algorithm, system compares the captured images with data base images which provide the result as image matched or not. Based on comparison result GSM modem sends a security alert to the authorised person which is 'person identified. You can enter now.' or 'unknown intruder trying to unlock, take action'. But, if the unknown person is in knowledge with authorized user then the authorised user will provide the entry to that person by using the android application. As soon as the message gets delivered it will reset the system.

WORK DONE

1) Comparison of Algorithm

There were so many algorithms available but we have used advance PCA algorithm for designing the system. Thus the summarised comparison of various algorithms can be tabulated as below:

Table 1 comparison of various algorithms

Performance characteristics → Name of algorithms ↓	Generation	Characters	Scopes	Limitations
Haar ↓	Combines the black and white	Create the positive and	In 1) face	Limited by illumination

	images	negative training sets of the images	recognition 2) feature extraction	
Viola – jones	Combines two Haar blocks with either colour in diagonal	Creates framework for images	In feature extraction in particularly	Limited by illumination as well as complex process.
Eigen faces	Created on the Eigen vectors of the image	Construct the covariance matrix on the basis of basis set.	In regeneration of image particularly	Faces same limitations of Haar.
Fisher faces	By pattern classification approach	Consider each pixel as an image in a high dimensional scope.	In face recognition with least regeneration error.	Works in low computational space but can be limited to linear region only.
PCA	By statistically generating principal components	By decomposing the data covariance matrix	In object recognition but particularly in feature extraction	It depends mostly on the covariance matrix and can lead to errors.
Advance PCA	By combining the PCA with characteristics of Eigen faces and Haar cascade	By creating the positive and negative dataset with keeping data worksheet with the record	In both face as well as feature extraction with high efficiency.	No limitation exception in light variation.

Thus from the above comparative table we conclude that the advance PCA algorithm is best suited for the highly efficient face recognition as it has lower limitations and errors.
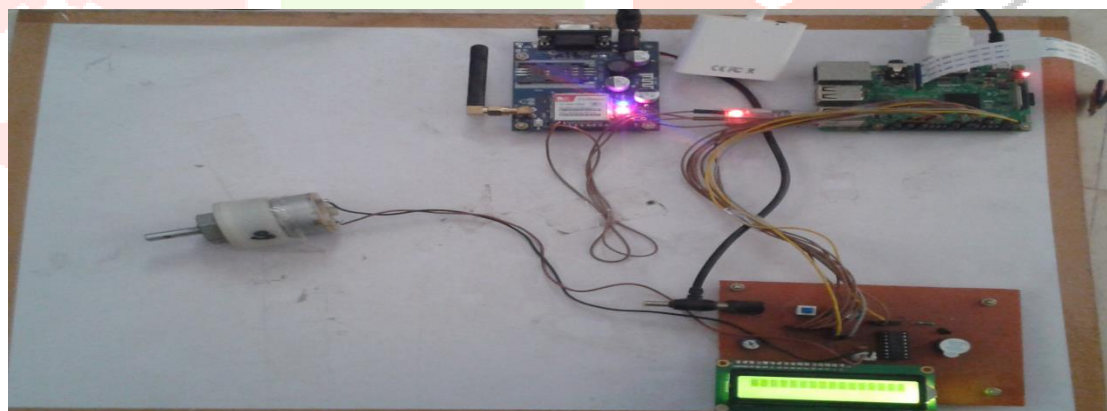
2) Block Diagram

Figure 1 view of "Design and Implement Advance Security System by Using Advance PCA Algorithm".

2.1 Constructional Details

In above figure shows the view of "Design and Implement Advance Security System By Using Advance PCA Algorithm". The   component working is described as follows:

Pi Camera module: Camera module is Pi camera interfacing to the raspberry pi module. It is used for captures an image and send captured image to the Raspberry pi 3B module. The captured images are used to create the database. This will also help to take videos in fraction of times if destined for it.

Raspberry pi 3B module: Raspberry pi 3B module is small computer board. When image taken by the pi camera, it is compared with stored face image. At the first time when we capture the image to create a data base raspberry pi module using pi camera captures six types of the images to create a data base in the system based on the different texture and intensity of light and this data base is compared with the live captured image. After comparing two images output is positive/negative; and based on the output response then it gives commands to GSM module and rest of the system.

GSM module: GSM module i.e. SIM 900(GPS/GPRS module) is used to sending a message to the authorities after comparing the images based on whether output is positive or negative. If output is positive then "Person Identified!! You can enter now!!" message send to the authority person otherwise send "unknown person is trying to unlock the door". If the unauthorised person is detected then the motor will block the door. If the unknown person is known to authorised user, the user through his android application will open the door for that person.

Display: The 16 pin LCD display will be a key instrument while checking the systems proper working. The LCD display will show every action of the system whether it is of camera or it is of door, it will give information regarding every action.

Wireless network: this network is basically a wireless network, in which the captured image of unknown person is send over the network to the authorizer users Gmail account. This will also help to interface the user with the system in the existing conditions. Also the android application will help the user to control the direct entry of the unknown intruder. The wireless network is also providing the platform to the have various controls such as automations, health care, security, etc.

Dc motor: the dc motor is the simple rotating device which has the ability to work as a blocking device. This motor is having the rotations and this will help user to program this motor for both clockwise and anti-clockwise rotation. In our proposed system the working of dc motor is controlled by motor driver IC. This will also help the user to control the direct entry of the intruder.

Power supply: the system is having two types of power supply adapters i.e. one for raspberry pi and one for sim900GSM module. The power supply in the system is divided in as 12v, 1amp adapter and 5v, 2amp adapter. The system of raspberry pi works on 3.3v max. Hence it is very much power conservative.

2.2 Working

Figure shows the view of the system "Design and Implement Advance Security System by Using Advanced PCA Algorithm". This system is basically Internet of Things (IOT) system. The working of this system can be explained as follows: Our project system can be viewed in two different sections, i.e. one for capturing and creating a data base and the other section is to capture the image and which is used for identifying or comparing the images in the database.

When first the system gets on, the LCD display will shows the message regarding the pi cameras on/off status. When the camera gets on, it starts to take images. When it takes the images of intruder, it compares the captured image with the images stored in the system database. Based on the result of comparison it produces the signals for the system to proceed. The captured image if gets matched with the database image, the LCD shows that "the person is identified; you can enter now". The same message is send over the GSM module to the authorised user.

If the captured image is not matched with the database image, it then blocks the door. The LCD displays "the unknown person is detected. Door is blocked". The same message is send over the GSM module to authorised user along with the captured image of unknown intruder. If the unknown intruder is known to user then the user can allow that intruder to enter by using the android application from his cell. This will help the authorised user to interface the existing scenario from the remote place.

In this way the system is very useful to the security where there is no any minute mistake is allowed. This system is very low power consuming and also is very powerful enough to produce a well eco-friendly and economic system in the terms of security for any kind and as the user can program it as per his requirement without allowing the system to go beyond the limit and hence this systems work is tilted towards the machine learning. Thus this provides a basic but strong system for user work and to reduce his efforts.

RESULT AND DISCUSSION

1) Result

The designed systems performance can also be determined in the figurate form as shown below:
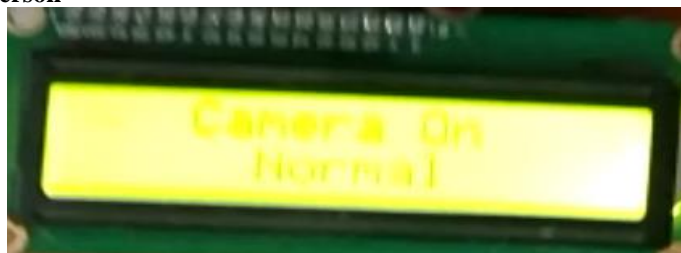
1) For the known/authorised person

Figure 2 Initialise the Pi Camera

Figure 3 Capturing the Image

Figure 4 Compare With Stored Database

As the face in the database matches with captured image, it will send the message to authorised user to inform that person is detected and can enter in home. (Image can't display).
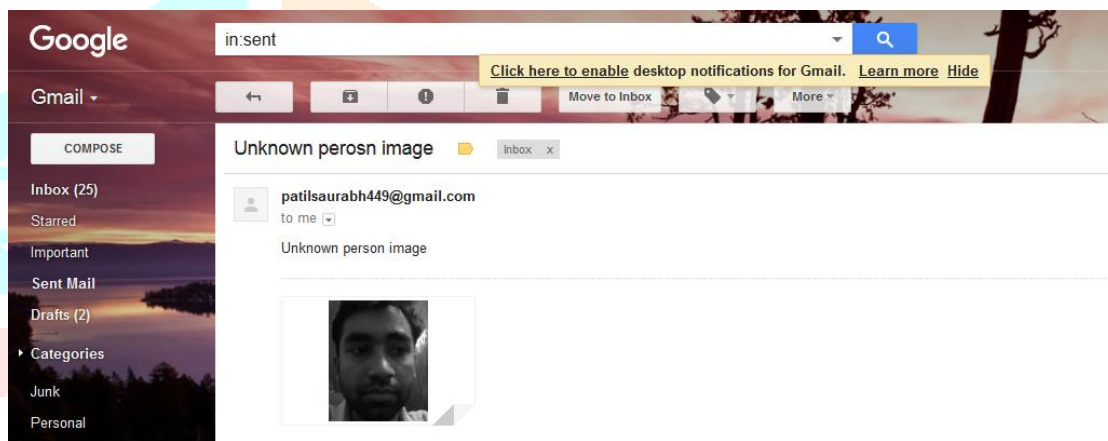
2) For the unknown person

Figure 4 Informing User about the Unknown Intruder using Gmail
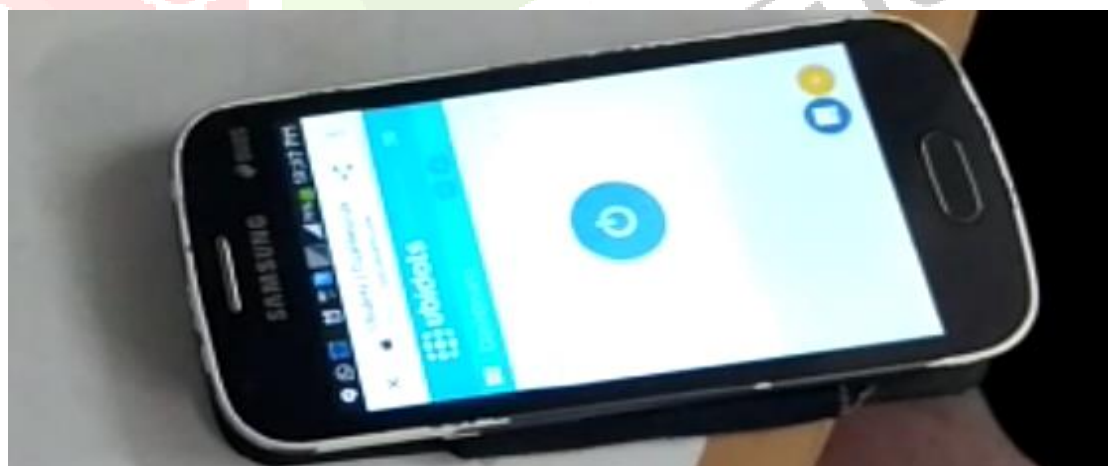

Figure 5 Allowing Known Person by using Ubidots Application

For the unknown person, the system will inform the user by Gmail and also allows the user to take necessary actions. The web/android application Ubidots will provide the additional benefit of simple to control and act. This also helps in the proper working of the system rather than losing space for the new applications.

2) Discussion

The figures above shows the initialisation of pi camera, capturing image, message send over GSM module, message send over Gmail account, rotation of the DC motor, etc. in the above figures. As shown in above figurate results the system gives the quick

response and also gives easier access to condition from remote place. The efficiency of system, if calculated may be in the range of 80-90% and also easily available android application will provide the great efficiency.

The implemented algorithm advance PCA works compatibly and freely over the designed system and hence we have found the higher side of designed system efficiency. The efficiency also high along with the desired flexibility as can be illustrated from above figures. Thus the designed system is much basic but highly efficient, flexible, low cost, easy to maintain, low space coverage, etc.

CONCLUSION

As we have seen the face detection/recognition system is basically depends on the proper working of pi camera module; so that the captured image can be processed by the advance pca algorithm in opencv system. The raspberry pi allows the captured image to process and also to give proper result when it was compared and based on that allows a proper action. This will also give additional feature of keeping the entry data. The android application allows the user to perform action from remote place. The advance PCA algorithm allows the system to correctly detect and recognise the intruder. The designed system is cheap, simple, reliable and highly reliable for any requirement of any system. This system as we have several use and fast process, still it will get limited to light intensity. But this problem can be resolved by taking more images to store in database.

FUTURE SCOPES

The raspberry pi alomg with infrared camera module can be a versatile move for creating new application. The system can be flexible enough to get fit in other system with very small adjustments. The future scopes for this sytem may vary from house automation and security to health care, from cabin attendance and security to air services,etc. if done more advancements we can find a uniform automation security system which can take care of appliances as well as infrastructure. So this system is advance but a basic system in front of applications of IOT field.

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