Implementing Real-Time Face Detection Techniques

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Abstract:- **This paper presents E-Watchman system which is a security based system. This system provides security through means of an android application and an e-mail .We can set authorized and unauthorized access of people within a particular premises. The concept of expected and unexpected timing is also implemented in this system. The face detection and recognition algorithms are implements and sends a real time alert.**

INTRODUCTION

In today's world, security of our near and dear ones is our prime concern. Gone are the days when we could depend on a watchman to guard our homes. But with the increasing population and threats we need something more secure. Hence shifting to a technologically smart and user friendly solution, we introduce a completely new dimension to your security with E Watchman System to provide much needed boost to your security and alerts.
E watchman system is a complete package of a security solution as per your needs. We basically offer you live detection and recognition and instant alerts of any security breach at your home or office with facility of alert through our mobile app so that you are in complete control of security of your home.

E-Watchman System is used in two key modes, watching for known alerts in real-time and alerting about the unusual events. Typically, watching for alerts requires face detection and real-time alerting is a localized function, e.g., the owner receives and reacts to the "intruder alert warning". Whereas unusual events may include warning the owner about the improbability of the predetermined activity. This system monitors the behavior, activities, or other movements, usually of people for the purpose of alerting or protecting them.

While applying face detection to provide real-time alerting, we determine the locations and sizes of
human faces in digital images. It is used to detect face and ignore anything else, such as bodies, trees

and buildings. The problem of finding and analyzing faces is a foundational task in computer vision. However, face detection is not straightforward because it has lots of variations of image appearance, such as pose variation (front, non-front), occlusion, facial expression, image orientation and illuminating condition. Many novel methods have been proposed to resolve each variation listed above. For example, the template-matching methods are used for face localization and detection by computing the correlation of an input image to a standard face pattern.

The approaches like feature invariant approaches are used for feature detection of eyes, mouth, ears, nose, etc. The appearance-based methods are used for face detection with eigenface, neural network, and information theoretical approach.

The system will detect the face and checks for the facsimile in the database.
This system is for the security of the people and to reduce the threat.
The real time alert will be send through an e-mail to the owner.
An android application is also developed to make it easier for the owner to recognize the threat and to take the required decision.

Related Work

The problem of face detection has been studied extensively. Face detection is defined as the procedure has many applications like face tracking, pose estimation or compression.
Face detection is a two class problem where we have to decide if there is a face or not in a picture. A wide spectrum of techniques have been used including template matching, model based detection, neural networks, maximal rejection classification, support vector machines (SVM) and color analysis. However, it is very difficult to design algorithms that work for all image background, races, sizes and geometries, and illuminations. As a result, face detection remains as much an art as science.
Methods of face detection are divided into different categories. This classification can be made as follows:

Skin color model-based approaches build a skin color model using Gaussian normal distribution since color is one of the most widely used visual features in face detection. Specifically, models convert the color image into an appropriate color space, such as YIQ, YCbCr, or HSI, to find skin color. These color spaces are more robust to the illuminations than the RGB color space and therefore are suitable for face detection under different lighting conditions.

Feature-based approaches first process the input image to identify and extract (and measure) distinctive facial features such as the eyes, mouth, nose, etc., as well as other fixed basis of comparisons or marks, and then compute the geometric relationships among these facial points, hence reducing the input facial image to a vector of geometric features. Standard statistical pattern recognition techniques are then employed to match faces using these measurements. Though different people have different skin color, human skin color is a powerful feature that is used to detect faces. Several studies have shown that the basic difference based on its intensity chrominance instead.

In Image based approach, there is a face pattern standard predefined is used to match the segment in the image to determine whether they are faces or not. To classify regions face or non-face classes it uses training algorithms. Image basedtechniques depends window multi-resolution scanning detect faces, thus these techniques have high detection rates but slower than the techniques of feature-based. Examples of techniques images based are Eigen-faces and neural networks. This approach has the advantage of simple implementation, but it cannot deal effectively with the variation in shape, pose and scale.

Template based approach used several templates to find out the face class and extract facial features. The template matching compares the face candidate image with the face template, checks the level of similarity and concludes whether it is human face or a non-face. The gray color is chosen as color space for the template matching because the best results have been obtained experimentally. The face template is an image made by averaging all faces on the training images. A few human faces are not detected if only one face template is used.

Edge detection approach is a very important area in the field of Computer Vision. For segmentation and object recognition, edges are used. Edges define the boundaries between regions in an image. They can show where shadows fall in an image or any other distinct change in the intensity of an image.

Erdem, C.E. presented a hybrid method for face detection in color images. They combined haar feature based face detector along with skin-color filtering. Haar feature based method that has a low number of missed faces but a high number of false detections. Then, using the skin color post-filtering method many of these false detections can be eliminated easily.

Kshirsagar, V.P. proposed a methodology for face recognition based on information theory approach of coding and decoding the face image. It is connection of two stages - Feature extraction by eigenface approach using Principle Component Analysis(PCA) algorithm and recognition using the feed forward back propagation Neural Network. The goal was to implement the system (model) for a particular face and distinguish it from a large number of stored faces with some real-time variations as well.

The seminal work that had the great impact in the field of face detection in 2000s was by Viola and Jones. The Viola-Jones face detector contains three main ideas that make it possible to build a successful face detector that can run in real time: the integral image, classifier learning with AdaBoost, and the attentional cascade structure.

Different methods and algorithms of face detection are present. The choice of a face detection method in any study should be based on the particular demands of the application. None of the known methods is universally best for all applications. In order to be successful a face detection algorithm must possess two key features, speed and accuracy. Generally, there is a trade-off between the two.

PROPOSED WORK

Our system works as follows:

Step 1: The camera will detect the face and capture the image of the person who is in the range.

Step 2: Then it will compare the face captured with the images already present in the database.

Step 3: If the facsimile of the face is found in the database then its NAME along with the timing will be sent to the owner.

This can be shown through the following example:

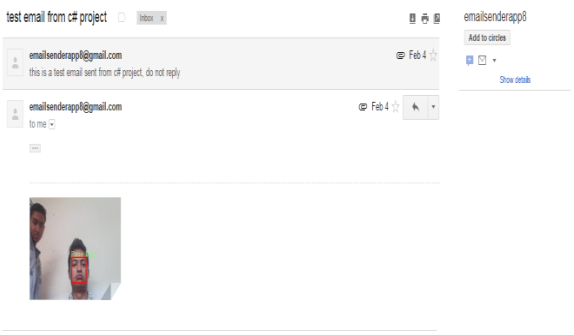
Step 4: If the face do not match with any of the images in the database then the captured image along with the UNKNOWN will be received by the owner in the form of an alert.

This can be shown by the following example:

Step 5: The owner will receive an alert message whenever any person comes in the specified range of the camera.

The alert will be send in the form of a message or an email with the name and image of the person.

This can be shown by the following example:

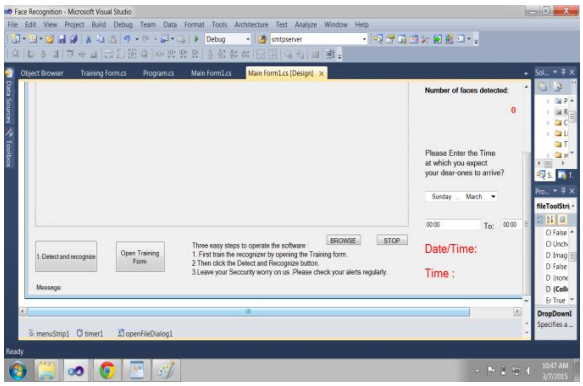


Step 6: The owner will decide whether to give the access to the person or not.

Step 7: The owner has an option to inform the police if a criminal activity is detected.

This system also provides the concept of expected and unexpected timings.
This makes the application a parental control application.

The timing can be set as shown below:



ANDROID APPLICATION:

An android application is also developed for the security purpose.

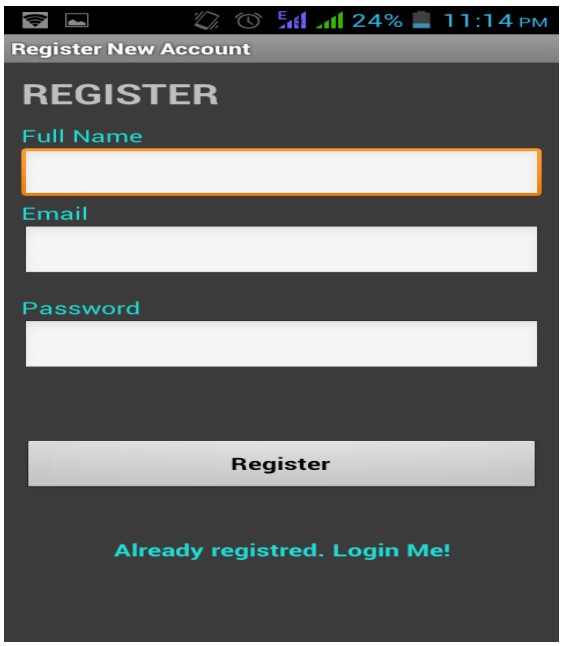
The application works as follows:

It sends a real-time alert to the owner as soon as any face is detected.

This application will provide the list of all the people who entered the premises with their complete information including the name and the image of the person.

The android application allows you to register yourself.
To use is application you need to register.

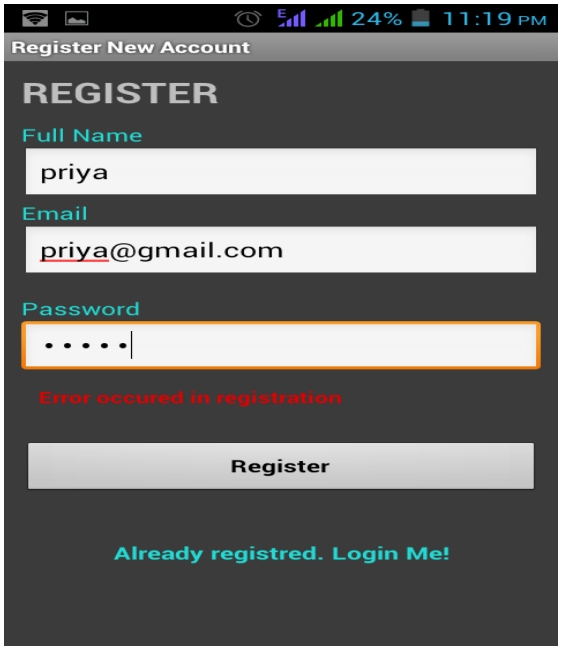
The registration screen is as shown below:



Enter the required Details:

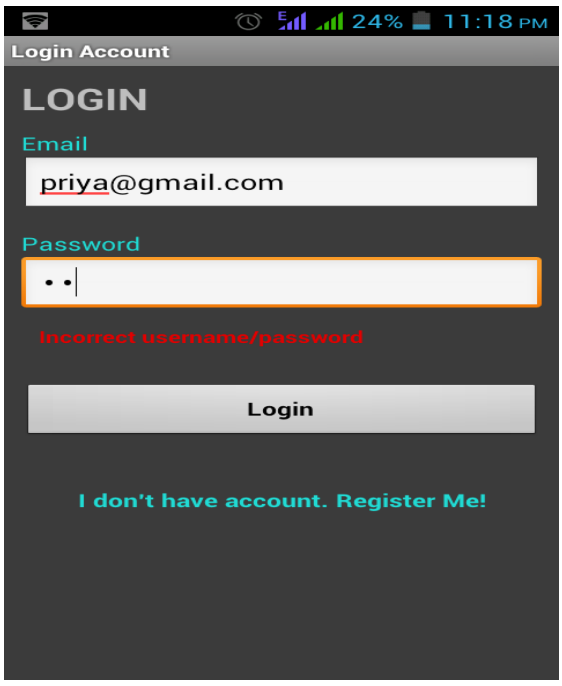
To register enter the required details , your name and Email.
Click on the register button to get registered.

The following figure shows how to register:



If already Registered you can Login By entering your correct E-mail and Password.

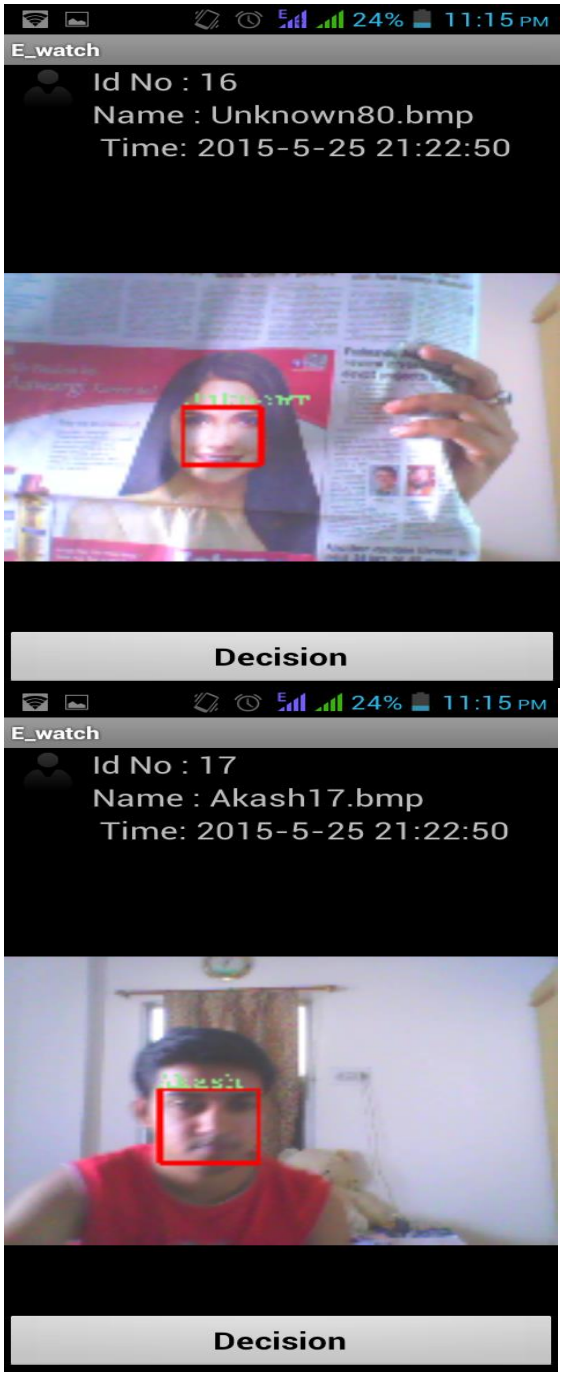
The login screen is as shown below:



Whenever a face is detected then the image captured will be received by the owner through this android application.

The owner will receive the time, NAME and image of the person.
If the image captured is not in the database then an UNKNOWN along with the name will be received by the owner.

This can be shown by the following example:



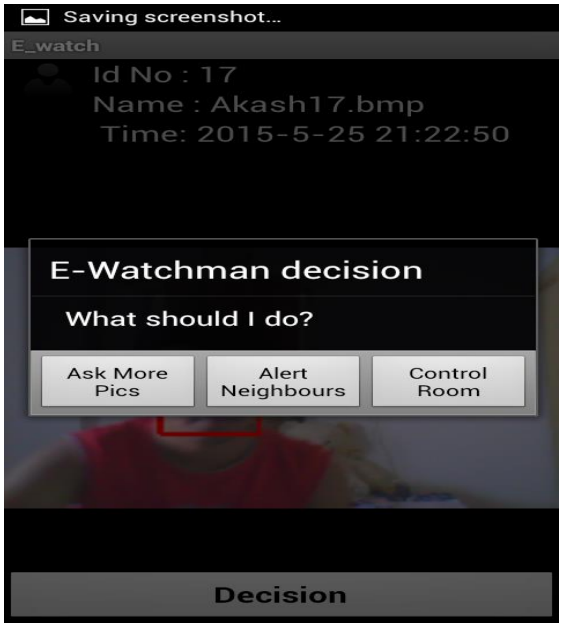
When the user receives the image, he/she needs to take the required decision

The decisions taken by the user can be:

ASK MORE PICS:
Here the owner will receive multiple images of the person till he gets satisfied.

ALERT NEIGHBOURS:
Here the owner can give an alert to their neighbours for security.

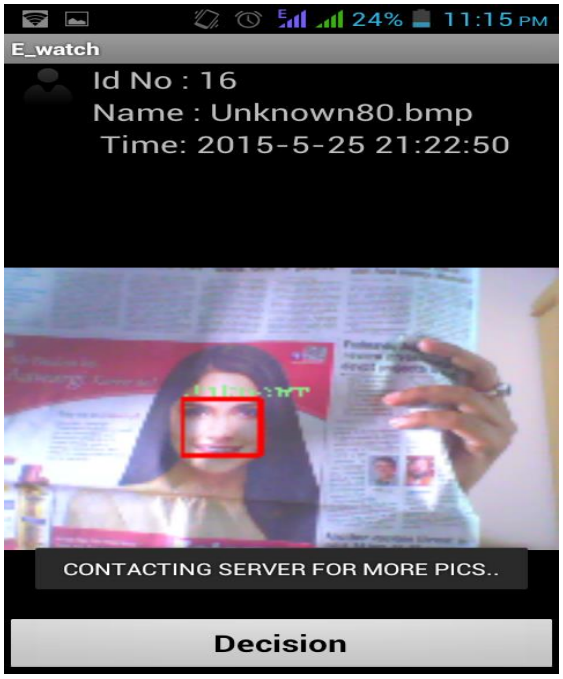
CONTROL ROOM:
Here the user will be connected to the control room if he needs some help.



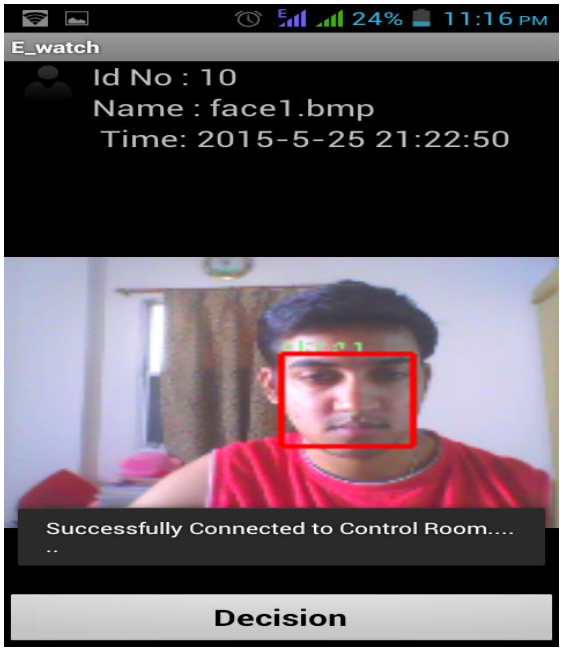
The decision taken by the user will be implemented.

This can be shown by the following examples:

Example 1:
If the user wants more images of the person.

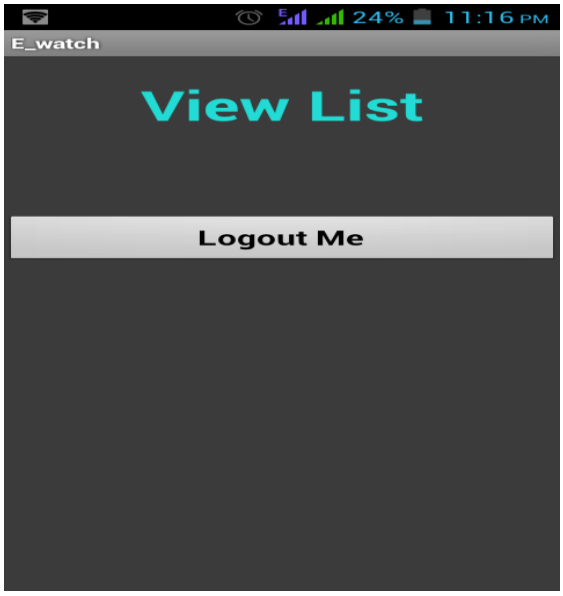


Example 2:
If the owner wants to contact the control room for some help.

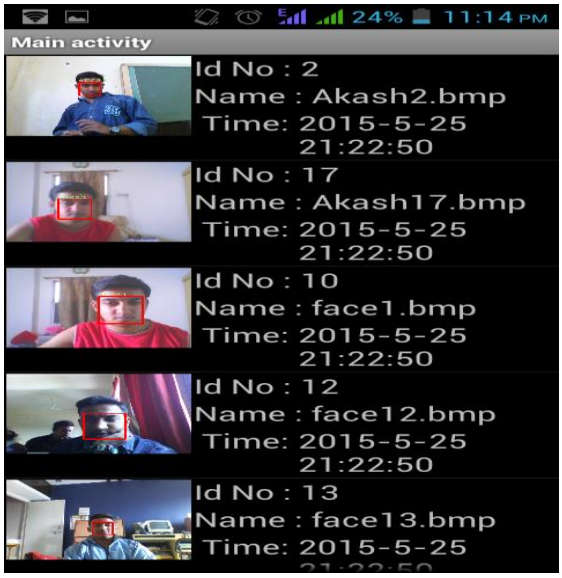


You can view the list of all the images and can logout from the application .

The view list and logout screen is as shown below:



This android application maintains a list of all the people whose images were sent to the owner along with the id no. and Time.



APPLICATIONS

Face detection can be used in biometrics, often as a part of (or together with) a facial recognition system. It can also be used in image database management, video surveillance and human computer interface. It will be useful for enhancing the security systems at various organizations. It can be used by wide group of people for different purposes like home security, authorized access to particular area, etc. Hence, reducing the manpower and the capital being invested. Concept of expected and unexpected timing makes the application a parental control application.

CONCLUSION

The algorithm for face detection and recognition has been implemented. We have focused on feature extraction and detection aspects of face detection problem. We have presented a face detector with a reasonably good accuracy and running time. The concept of expected and unexpected timings is also implemented in this system.
The android application for the security purpose is also successfully developed which gives the name along with time when the person entered.

Future Scope:

1. It can be used on a large scale by deciding the geographical areas and using the pre installed cameras.
2. Analysis of secured areas:
   Dedicated area wise Database which records no of colour hits to study the security pattern of the area which will help us to decide the safe areas for building homes.
3. Central database which can help police to trace a wanted thief or criminal.
4. Mechanical locks which lock and open as per your permission.
5. Option to provide timing slots at which you expect your dear ones to arrive and provide live streaming for that slot in your mobile app by pressing green button.

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