COGNITIVE SECURITY SYSTEM BASED ON IMAGE COMPARISON AND MOTION DETECTION WITH ABLE MEMORY USAGE

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ABSTRACT

Security is the top most priority for everybody. The newest models of cars have security alarm, people have security system installed in their houses, and all of these ensure safety and reduces the risk of being robbed. Nowadays people are more carefree than they were before because of the advent of the latest technology that provides you with complete security. One thing that is common in every person is the sense of security. Today people are finding ways to secure their properties and/or possessions.

Humans are very good at recognizing faces and complex patterns. Even a passage of time doesn't affect this capability and therefore it would help if computers become as robust as humans in face recognition. The face plays a major role in our social intercourse in conveying identity and emotion. The human ability to recognize faces is remarkable. We can recognize thousands of faces learned throughout our lifetime and identify familiar faces at a glance even after years of separation. Block Matching Algorithm has been used to do image comaprison and detect t he person's face and amtch with the database and determine intruders to prevent any thefts or disasters and hence can be used as a security measure.

KEYWORDS: *Block Matching Algorithm, Face detection, Image comparison, Motion Detection, PCA*

I. INTRODUCTION

CCTV (Closed Circuit Television) is a visual surveillance technology designed for monitoring a variety of environments and activities. CCTV systems typically involve a fixed communication link between cameras and monitors. The main drawback of this is someone should be monitoring the system continuously.

When a security camera is installed, a human being has to be on alert all the time while the camera is on since any little movement can require attention of the supervisor. But most of small objects do not need the supervisor's attention since they could be birds, cats, dogs etc.

Current security system [1] needs huge memory to store the video records or an image. And the current system does not have knowledge of identifying authorized persons in a system. Here security guard has to segregate authorized and unauthorized persons. Since alerting the threat is very important, current systems need enhancement as it is not up to the mark.

The proposing new system can capture an image periodically with a predefined time interval and compare this image with a pre-captured image [1] to detect a movement and to calculate the size of moving object through the image. The size of moving object is calculated and additionally the decision whether the image containing a certain moving objects which seems to be worth of human attention should be registered or not is made automatically. When motion occurs captured image is compared with the authorized faces in the database, if any match is found then the system won't generate alerts, else it starts alerting the owner. The system alerts as fast as possible by sending mail to the authenticated users and it also sends a message to the authenticated user by using a GSM device.

Our proposed system can help in many ways:

- Checking for criminal records.
- Enhancement of security by using surveillance cameras in conjunction with face recognition system.
- Detection of a criminal at public place.
- Applicable in almost all places where we need security.
- No need of Human Huge memory.
- Human attention is not required.

1.1 Hardware Requirements

The most common set of requirements defined by any operating system or software application is the physical computer resources, also known as hardware, A hardware requirements list is often accompanied by a hardware compatibility list (HCL), especially in case of operating systems. An HCL lists tested, compatible, and sometimes incompatible hardware devices for a particular operating system or application.

The below are the Hardware requirement for Motion Recognition system

- Hard disk: 40 GB
- RAM: 512 MB
- Processor Speed: 3.00GHz
- Processor: Pentium IV Processor
- Web Camera: 2 mega pixel and above
- GSM (Global System for Mobile Communication):
- SIM (Subscriber Identity Module)

1.2 Software Requirements

Software Requirements deal with defining software resource requirements and pre-requisites that need to be installed on a computer to provide optimal functioning of an application. These requirements or pre-requisites are generally not included in the software installation package and need to be installed separately before the software is installed.
Below are the Software requirements for Motion Recognition system
Operating System: Windows-XP professional
Programming Language:
Java: Because of its extensive features Java (JDK 1.6) has been used to develop the proposed project.
Java Media Framework:
The Java Media Framework API (JMF) enables audio, video and other time-based media to be added to applications and applets built on Java technology. This optional package, which can capture, playback, stream, and transcode multiple media formats, extends the Java 2 Platform, Standard Edition (J2SE) for multimedia developers by providing a powerful toolkit to develop scalable, cross-platform technology.

II. FUNCTIONAL MODULES

Module 1

(i) Name of the module: Motion Detection.
(ii) Inputs: Takes the images from the camera instantly.
(iii) Output: Compares the Images frequently and gives the result.
(iv) Purpose: It takes the images and calls the method to compare these images.

Module 2

(i) Name of the module: Image Comparison
(ii) Inputs: It takes two images to compare
(iii) Output: Comparison of the captured images will be done. If there is a difference the image is saved or else comparison is continued.
(iv) Purpose: It will compare the two images taken by the camera.

Module 3

(i) Name of the module: Face Detection
(ii) Inputs: It takes the captured image and database images
(iii) Output: If the image matches with any of the database images, processing will be continued or else it starts alerting.
(iv) Purpose: To check whether the image is in the database or not

Module 4

(i) Name of the module: Sending Mail.
(ii) Input: It takes the image having difference.
(iii) Output: Image will be delivered to the mail.
(iv) Purpose: It is to send an image to mailbox.

Module 5

(i) Name of the module: Sending Message.
(ii) Input: It takes the message to send.
(iii) Outputs: Message will be delivered to the Mobile.
(iv) Purpose: It is to send a message.

III. SYSTEM ARCHITECTURE

Fig 3.1: Motion Detection System block diagram

The result of image processing is to determine the nature of the moving object. In this implementation, the user can configure the threshold value of minimum movement. If the detected movement is smaller than the threshold value, the system considers that the noise in an image makes a movement, so the movement is negligible [2].

Below are the functions in Block matching Algorithm [3],[4].

A Block Matching Algorithm (BMA) is a way of locating matching blocks in a sequence of digital video frames for the purposes of motion estimation.

The purpose of a block matching algorithm is to find a matching block from a frame i in some other frame j, which may appear before or after i. This can be used to discover temporal redundancy in the video sequence, increasing the effectiveness of interframe video compression.Block matching algorithms make use of criteria to determine whether a given block in frame j matches the search block in frame i.

The below diagram shows the image has motion that will be indicating by using the rectangle box. The whole image will be divided in to number of horizontal rows and vertical columns. Each block created in an image will be comparing with the block created in another image.

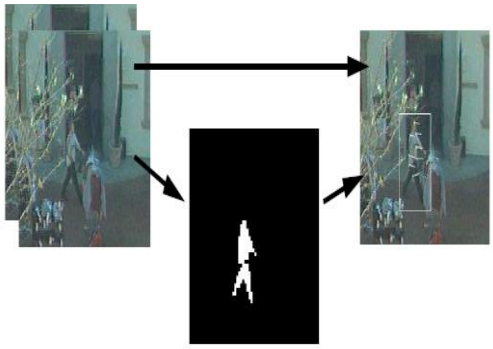

Fig 3.2: Image Comparison by using Block matching Algorithm

The task of the face recognizer[5] is to find the most similar feature vector among the training set to the feature vector of a given test image. Here, we want to recognize the identity of a person where an image of that person (test image) is given to the system. The PCA is a feature extraction algorithm in this project. In the training phase, extracting the feature vectors for each image in the training set is required. Let *-A* be a training image of person A which has a pixel resolution of *M £ N* (*M* rows, *N* columns). In order to extract PCA features of *-A*, you will first convert the image into a pixel vector *ÁA* by concatenating each of the *M* rows into a single vector.

The length (or, dimensionality) of the vector *ÁA* will be *M £N*. In this project, you will use the PCA algorithm as a dimensionality reduction technique which transforms the vector *ÁA* to a vector *!A* which has a dimensionality *d* where *d ¿ M £ N*. For each training image *-i*, you should calculate and store these feature vectors !j.

In the recognition phase, a test image *-j* of a known person will be given. Let *®j* is the identity (name) of the person. As in the training phase, we should compute the feature vector of the person using PCA[6] and obtain !j. In order to identify j, you should compute the similarities between !j and all of the feature vectors !j's in the training set. The similarity between feature vectors can be computed using Euclidean distance. The identity of the most similar !j. will be the output of our face recognizer. If *i = j*, it means that we have correctly identified the person *j*, otherwise if *i 6= j*, it means that we have misclassified the person *j*[7].

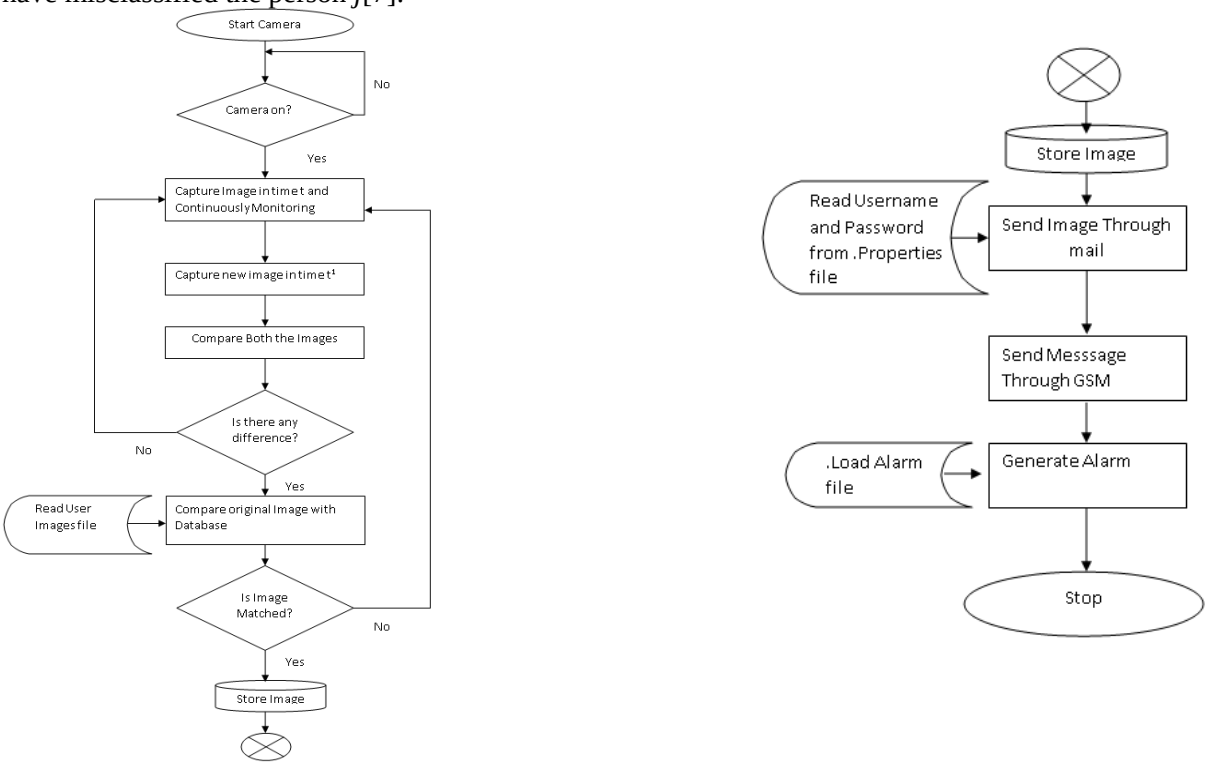

Fig 3.3: Dataflow Diagram for motion detection using camera

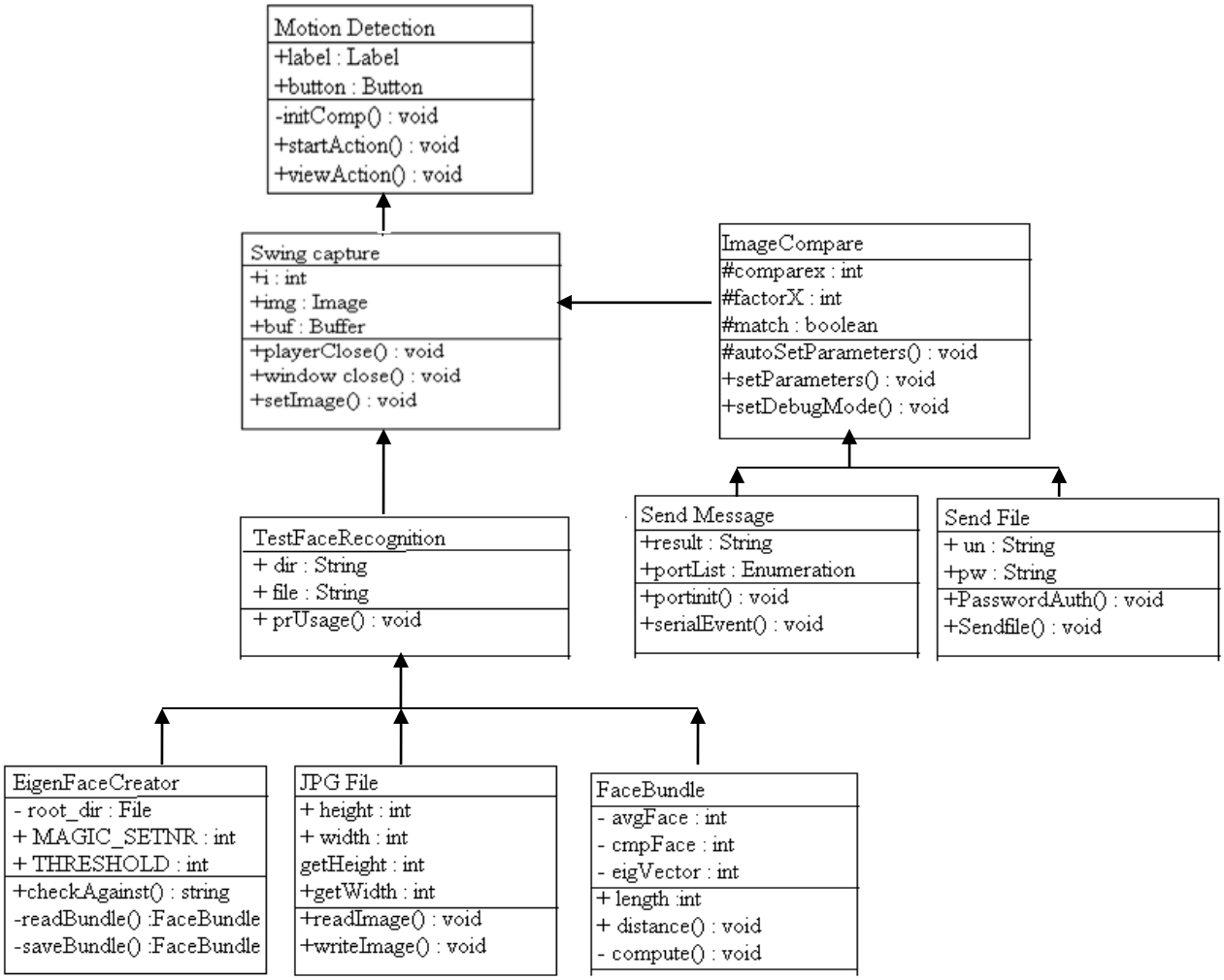

Fig 3.4: Class Diagram for the Surveillance of Motion Detection System

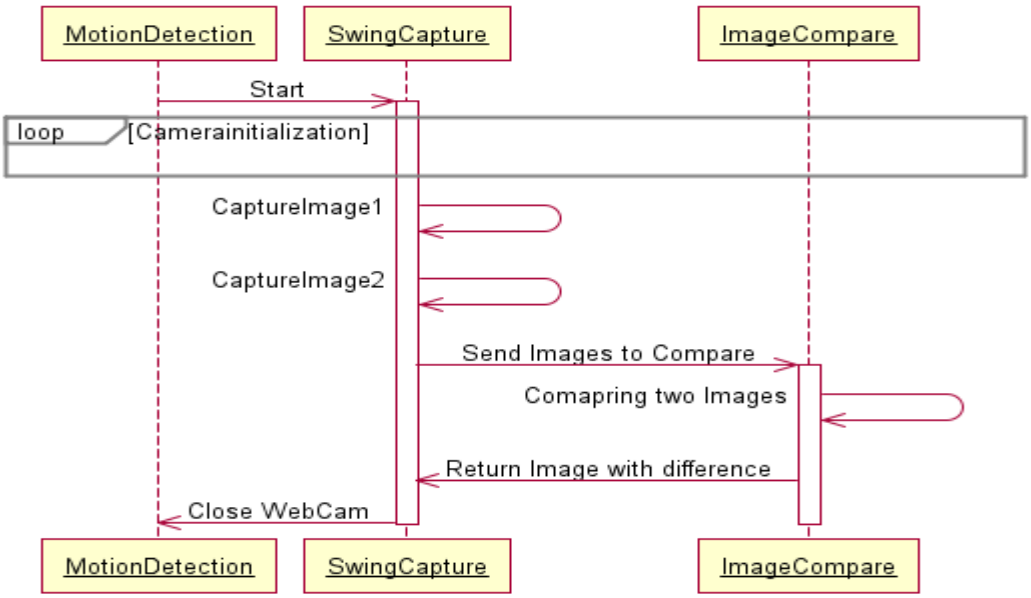

Fig 3.5: Sequence Diagram for Camera Initialization

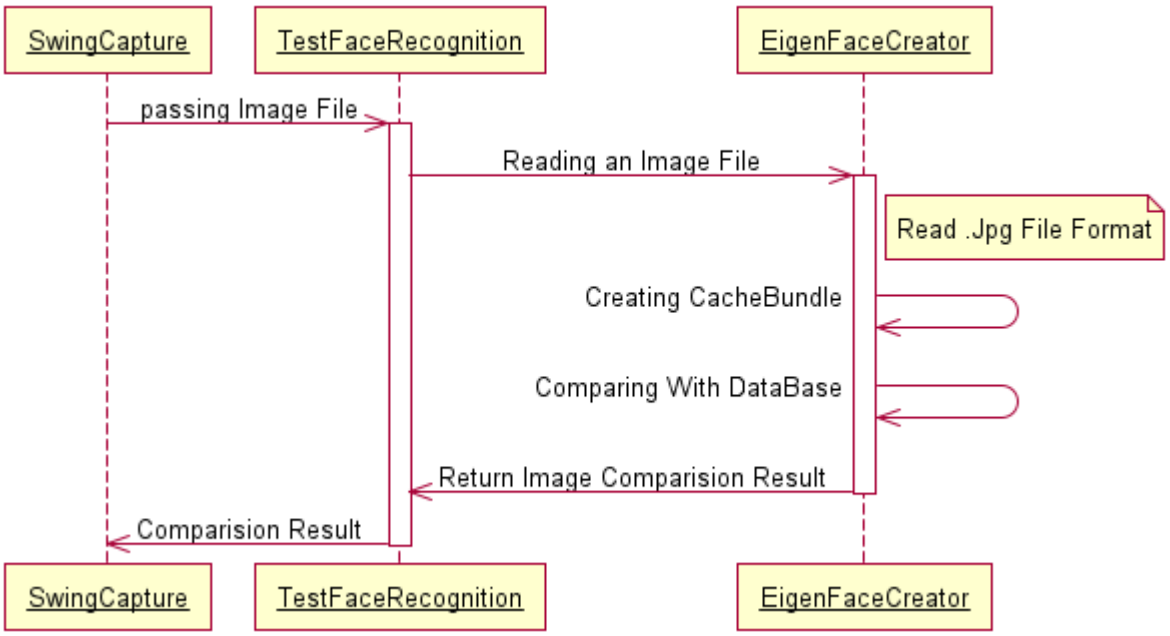

Fig 3.6: Sequence Diagram for checking image in Database

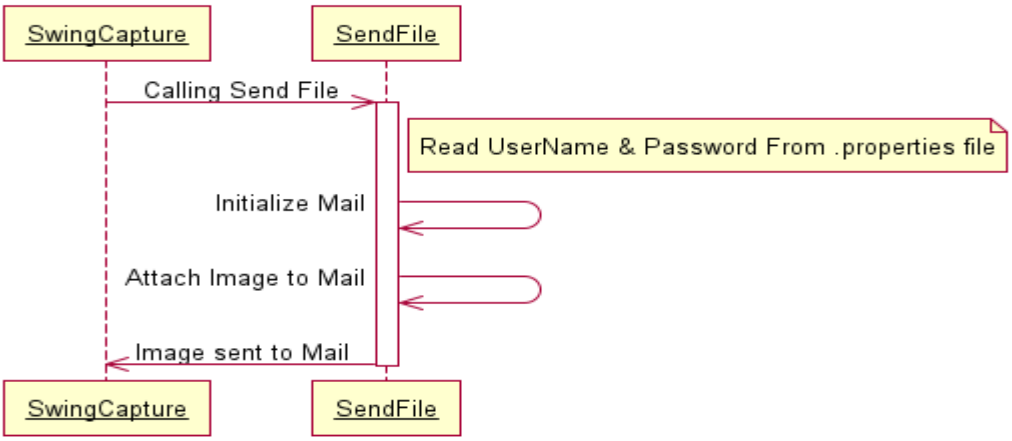

Fig 3.7: Sequence Diagram for sending a File

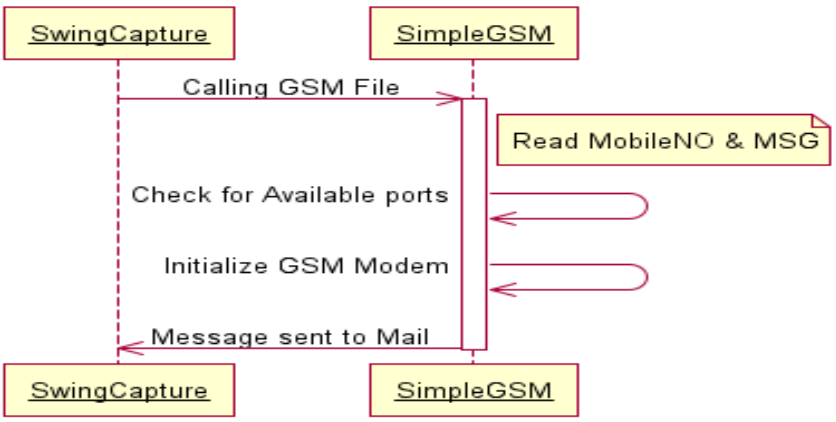

Fig 3.8: Sequence Diagram for Camera Sending Message

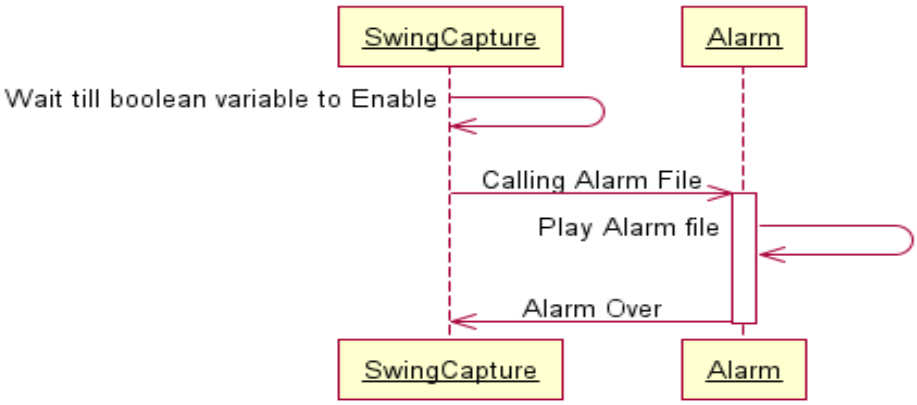

Fig 3.9: Sequence Diagram for Generating Alarm

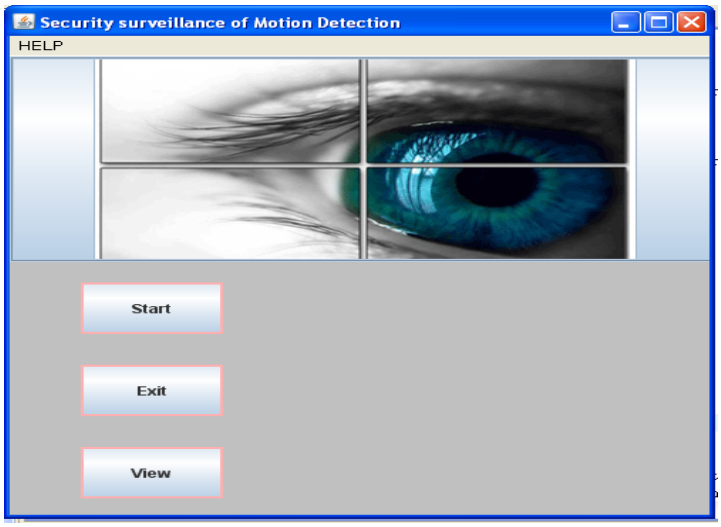

Fig 3.10: Main window of Motion detection system

The Front end window page is as shown above. Here the user as to click start button to start the process. If the camera is not connected to the system then will get an exception.

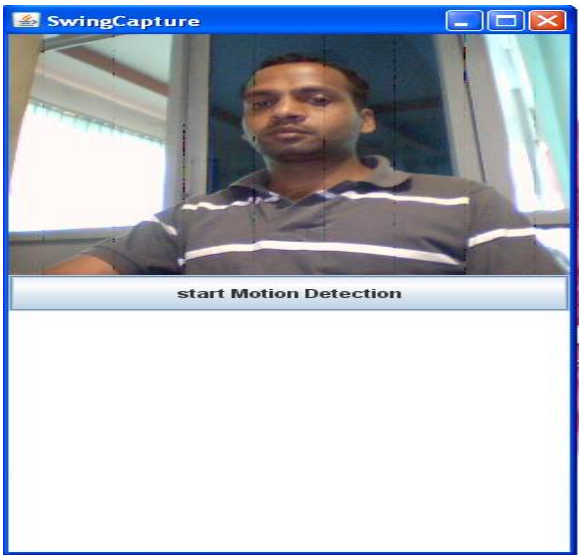

Fig 3.11: Camera started page

The snap shot which is shown above is when camera is started. The window has one button to start motion detection system.

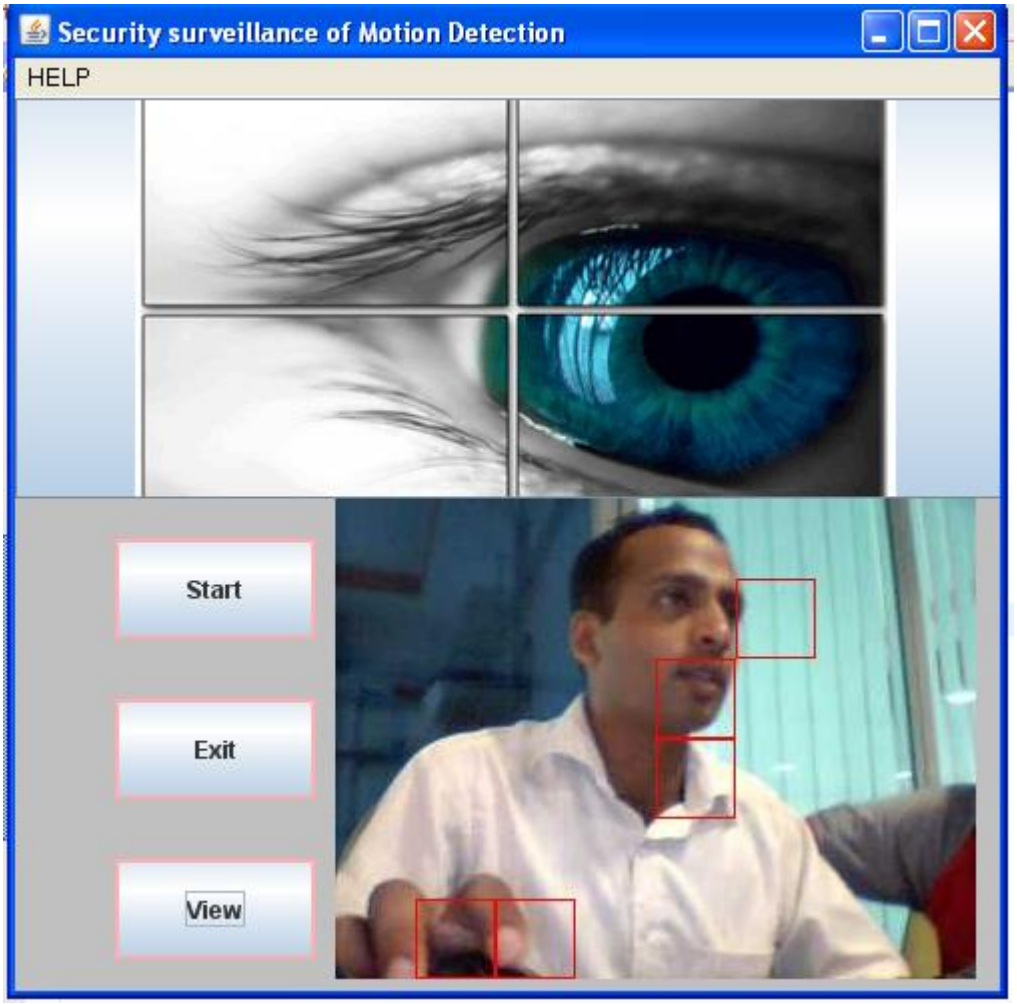

Fig 3.12: Image with Motion

The snap shot which is shown above is when we click view button. When motion occurs image is captured and stored in the database. This image can then be viewed by using the view button

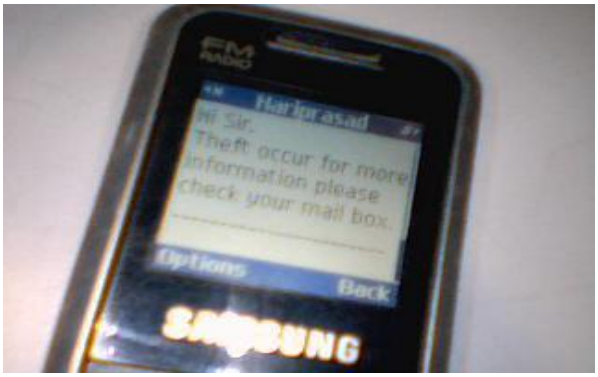

Fig 3.13: Message Received to Mobile

The snap shot which is shown above is when we get a message. Once we get this message it means that theft or some motion has occurred in the security system.

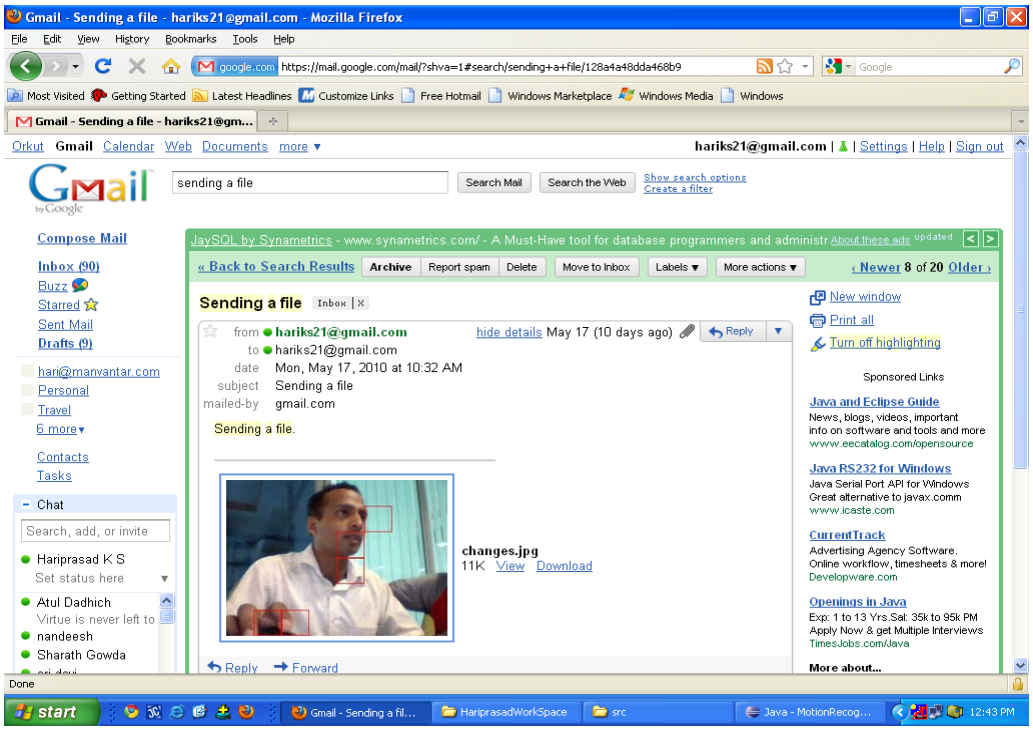

Fig 3.14: Image received to mail

The above snap shot is taken when the image is received by the authenticated user through a mail. This image will helpful for further verification. Using this user will come to know the type of theft occur.

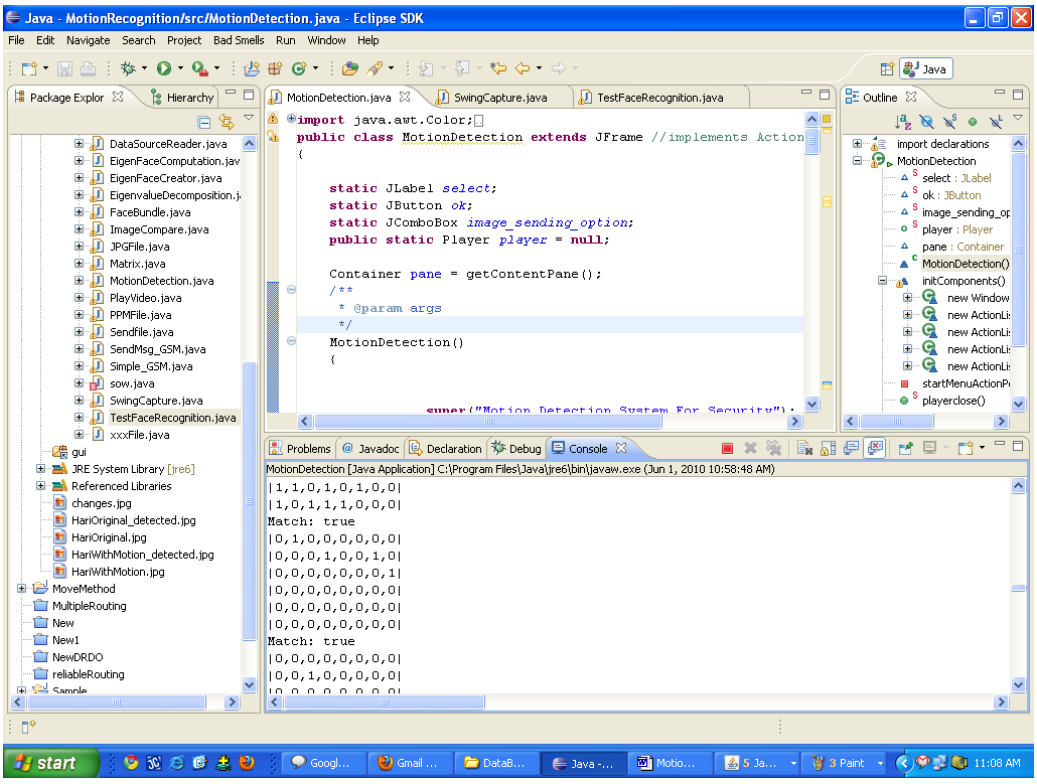

Fig 3.15: Matrix value when images compared

The above snapshot shows the matrix values generated when images are compared. Using these matrix values, the Boolean value will be enabled to either true or false.

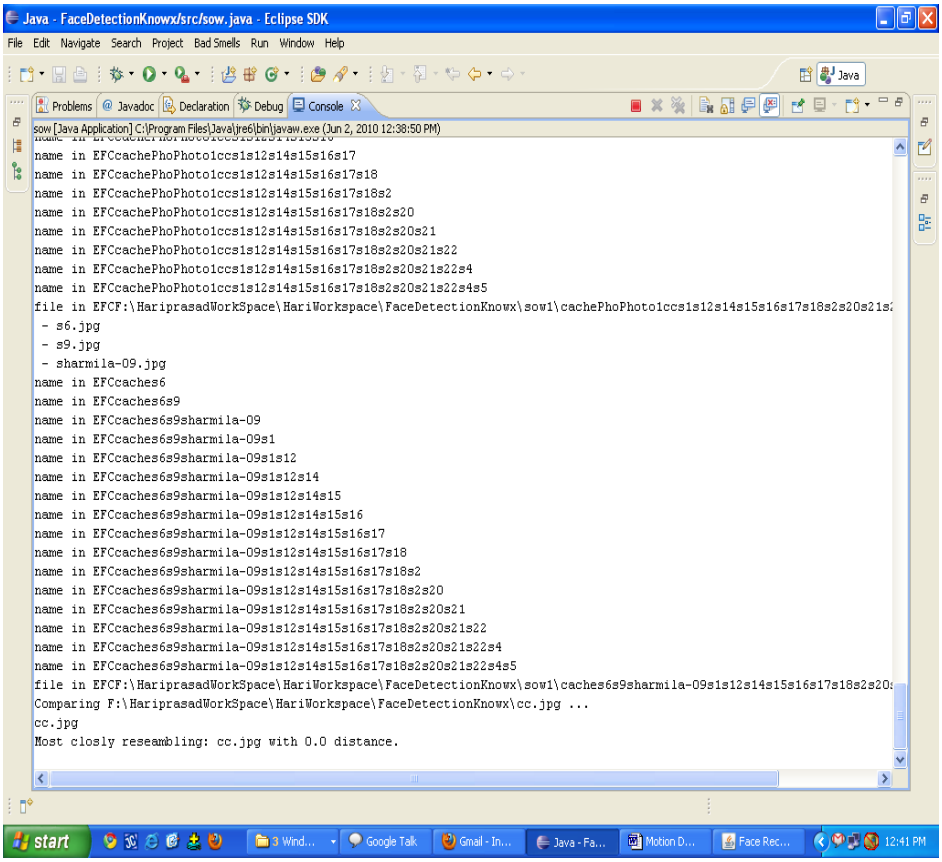

Fig 3.16: Image matched in database

The above snap shot shows image comparison with the database image. Here the system is checking whether the person entering is authenticated or not. The above snap shot shows creating the face bundles using principle component analysis and comparing with the image in the database

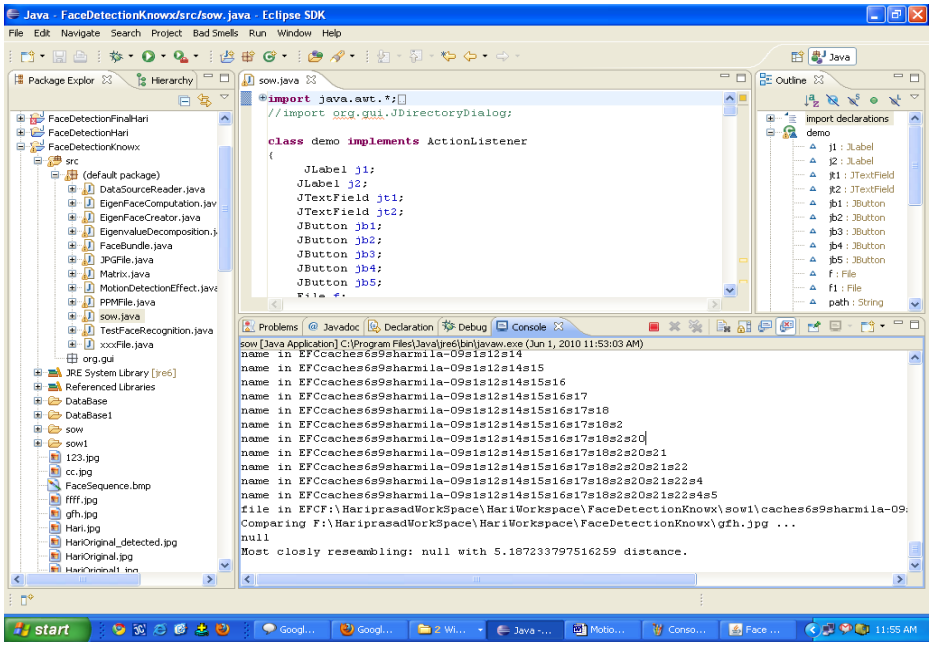

Fig 3.17: Image not-matched in database

The above snap shot shows image comparison with the database image as a failure.

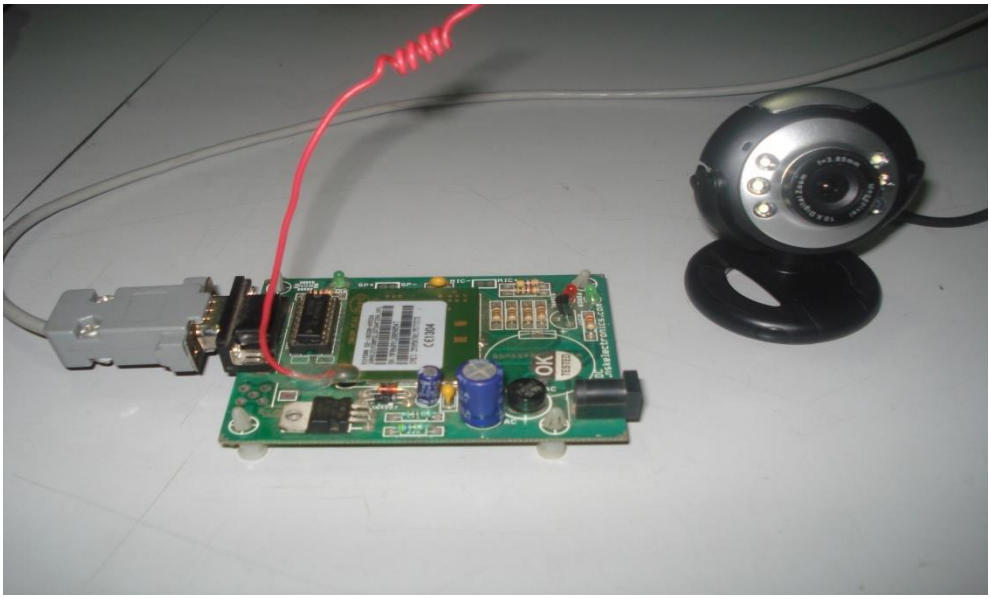

Fig 3.18: Device using for motion detection and alerting

The above snap shows the devices connected to the system for motion detection.

IV. CONCLUSION AND FUTURE ENHANCEMENTS

Application of motion detection may not be a new invent in world of Engineering Technology. The counting security system which is developed in real time system makes this project appropriate to develop further enhances.

As the conclusion, the project has several potential advantages which give the benefit to stadium management particularly and commonly the End Users.

- ❖ Improve the security level

Our new proposing system provides high level security by alerting system in many ways. This system can resolve the problem of continuous monitoring of the security system by a human.

- ❖ Low cost installation

Since low cost components such as Camera, GSM and SIM are required to be installed, the system is cost effective.

- ❖ Automatic authentication

If unauthenticated user enters in to the security system, the user will be automatically identified by using the face detection technique.

- ❖ Maintainability

Memory which is required to store the image is very less so maintenance of the system is easy and user friendly.

However, a few limitations are demonstrated.

- The algorithm is sensitive to head scale.
- It is applicable only for the Fixed Camera.
- As in many other face recognition related literatures, it demonstrates good performance only under controlled background, and may fail in natural scenes.

The proposing security system will help end-users to effectively provide security to Home, Office, Shopping Malls and Border Security etc. Proposing system is not only indicating the motion but also checking the authorization.

By using the availability of low cost hardware devices like GSM and Camera, alerting the motion occurred by message and sending a captured image to the mail is achieved.

Due to limitation of time as well as resource constraint, the project work could be limited to only certain specific functionality. But in case such limitations or constraints could be overcome, following feasible future enhancements could be proposed.

- The computation time of the proposed method is large because of hardware interfacing for multimode alert so we can reduce the computation time.
- To apply this method to the Face detection for authorization, further study is required for accuracy.
- The future work could be extended to accomplish Video on Demand (VOD) when requested by the authorized user.
- The future work could be extended to control the devices in remote places by using simple short message service.

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