INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

# CRIMINALS IDENTIFICATION SYSTEM (CIDS) USING FACE RECOGNITION

**Sherif Kamel Hussein*[1] & Amal Fahad Almejwal[2]**
[*1]Associate Professor, Department of Communications and Computer Engineering
October University for Modern Sciences and Arts, Giza- Egypt,
Head of Computer Science Department, Arab East Colleges for Graduate Studies, Riyadh, KSA
[2]Co- Author: Master of Computer Science, Arab East Colleges for Graduate Studies,- Riyadh, KSA

## Abstract

By evolution of communication technology and face recognition research, many countries start applying face recognition in many places like Airports, Banks, roads...etc. In addition to that, face recognition becomes one of areas that challenged and required by many countries currently to identify criminals via their faces to prevent increasing the rate of crimes. There are many ways that can be obstructed by humans to avoid this recognition like wearing colored contact lenses, growing a mustache, putting on intense make-up...etc. In this paper the authors introduce new system that depends on face identification and image processing to identify criminals from their faces even after a long time. It is designed to facilitate managing a criminal identification by making admins more able to Add a criminal to database, update their information and deleting them from the database, Check criminal records and Add cops to the database... etc

## Introduction

Face recognition becomes a popular area of research. Nowadays researchers start to apply it in researches and applications to solve problems. It is typically used in access control systems, network security systems, surveillance, entertainment and multimedia information processing areas. Now we can monitor many cameras in our society where are located in many public places around us. The goal of these cameras is for more safety and to reduce the rate of crimes.

Face recognition is a challenging and difficult problem in the field of image analysis and computer vision which has taken great interest in the last few years because of its many applications in various domains. Image processing has many fields of applications and uses and one of most popular application is the face recognition. Because of face recognition has many challenges, like to identify person after many years, changes in illumination, expression changes and occlusion for face recognition, in addition to the need for face recognition in finding criminal because the most criminals are aware of thumbprint identification, so many research labs try to solve this problem and find the best solutions for it and start applying the research methods and find the results. Some of these companies like Microsoft and Google developed some computer vision methods that help to identify the person through his face even after many years.

Face recognition processes are illustrated in Figure 1.The main problem can be addressed as how to locate the human using his/her image and find any information about him/her if this human known before by the system. Most of countries started to apply it by checking criminal records database and search if there is any similarity between any criminal record data like his image then, start searching for this image to identify the criminal in fastest way [1].
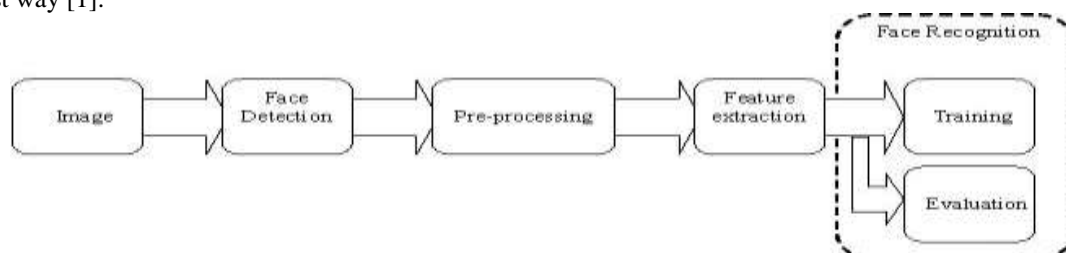


*Figure 1 Face Recognition Steps*

INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

## Literature Review

Face recantation and detection is bio-metric approach that employs computer techniques, algorithms and automated systems to identify human faces in digital images that might contain objects and other things based on the physiological characteristics. Face recognition mostly used in security systems or security purposes also the interest to use it in other fields has increased these days, as a fact the facial detection and recognition has potential for wide range of applications related to law enforcement as well as enterprise systems. In 1997 Yali Amit, Donald Geman, and Kenneth Wilde started using image processing techniques for classifying handwritten digits and identify it based on its shape. They provide some new features in splitting and partitioning shape using some steps as transforming image by replacing pixels values by five bit codes that show topography in boundaries of any shape. They provide good results in identifying handwritten digits after training their application and algorithm [2].

In 2000, Ming-Hsuan Yang, Dan Roth and Narendra Ahuja presented SNoW, a learning architecture in domain for visual processing system for detecting images and faces in images to overcome some problems like face rotation, their poses, facial features and illumination conditions. The experiment showed that the method outperforms other methods in detection rate and overcome false detections [3].

In this period many researches showed the using of image processing techniques to recognize the face but these researches were unable to overcome many problems such as false detections, illumination, face rotates...etc [4-6].

With the continuous technological evolution which helps in developing new modern algorithms and techniques, these algorithms and techniques can resolve problems that had been difficult in the past. In 2004 Viola Michael Jones and Paul began worked together to resolve most of the problems met by researchers and work to get the best possible results in face recognition and had come to satisfactory results. They developed a system that was able to detect faces extremely rapidly, and the system achieved high frame rates working in information presented in a single image [7].

With the increasing need to use new technologies in industry and medicine...etc, researchers began using those techniques to help resolving everyday problems that correspond to human society and work to overcome them. Researches started using image processing techniques in many fields like medical fields for some problems like disease recognition using X-Ray...etc. Also in industry,image processing plays an important role to solve many problems such as drug manufacturing and identifying junk food...etc [8-10].

In 2012, Uttam Mande1, Y.Srinivas2, J.V.R.Murthy started collaborating with Andhra Pradesh police department to apply the image processing and face recognition techniques to find criminals in the best way using Closed Circuit TV (CCTV) cameras and they tried to find the criminals by mapping the criminals using the Generalized Gaussian Mixture Model [11].

Security becomes one of the most challenges that face society and the increasing crimes, so researchers start applying the concept of image processing and face detection to identify criminals from their faces and compare them with the existing ones in the criminal records database by extracting their information or make an alarm to prevent terrorist or criminal acts [12].The Viisage's Face recognition technology had been deployed in Fresno Yosemite International (FYI) airport In October, 2001 to enhance the airport security system[13,14]

W. H. R. Fernando and his team merged the use of fingerprint and face detection techniques in the same application to get the best result accurate to the criminal data that exists in database and tried to solve the problem that faced all researches before by merging these techniques [15,16].

**The Newly Proposed system -Criminals Identification System (CIDS) Using Face Recognition**
The Criminal Identification System (CIDS) is an Image processing application that resolves increasing crime problems in a reduced cost, risks and less time. In this section the authors will show the main component of the system and how system modules interact with each other and also describe the main functionality of the system and the role of each user and how information domain of CIDS is transformed into data structures.

### System Overview

Figure 2 shows the modules of the Criminal Identification System (CIDS). The three main modules in the systems are :

- Login & User Management.
- Criminals Management.
- Search Management.

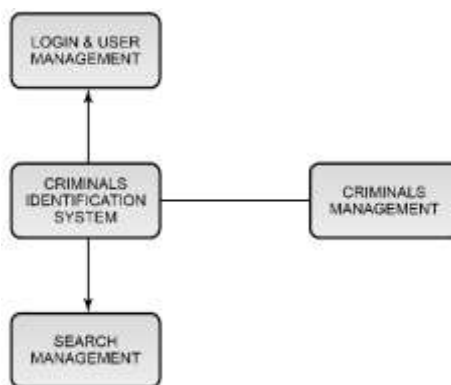Each module interacts with others to serve system functionalities and help to provide accurate result.



*Figure 2 System Overview*

### System Module Functions

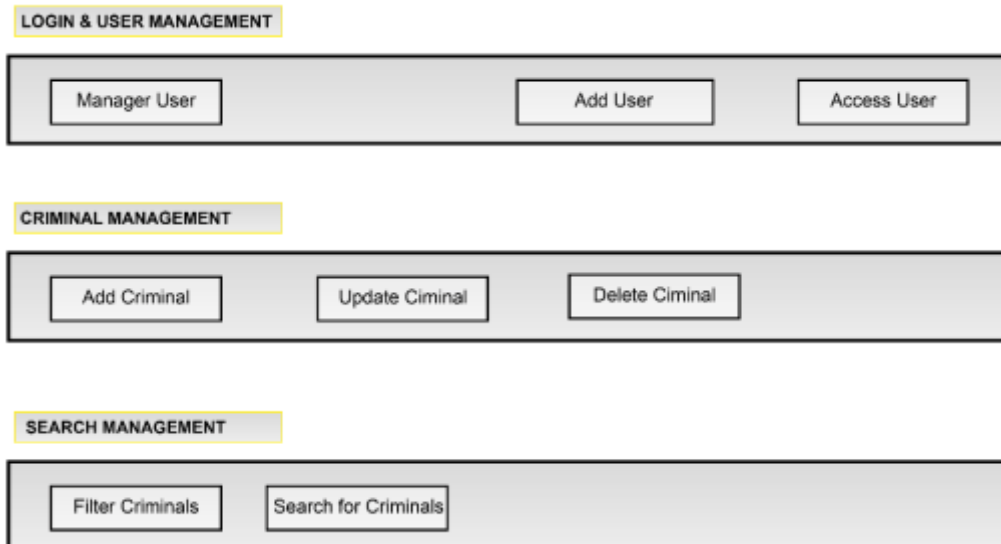The system modules functions are shown in Figure 3 ,these functions can be explained as follows:



*Figure 3CIDS Functions*

### 1- Login & User Management :

This module is responsible for logging in to the web application as an Admin or Cop. The Admin can add, update, and delete cops. In addition to Cops can manage their information.

INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

**2- Criminals management:**
Admin can add, delete, update criminals from the system database, while Cops only can update the criminal records.

**3- Search management:**
**Admin** and **Cops** can search for any criminals using their photos, jobs or names.

**System Block Diagram**
Figure 4 explains how data is processed and transferred in a system. The graphical depiction identifies each module of data and how it interacts with other data sources to reach a common output.
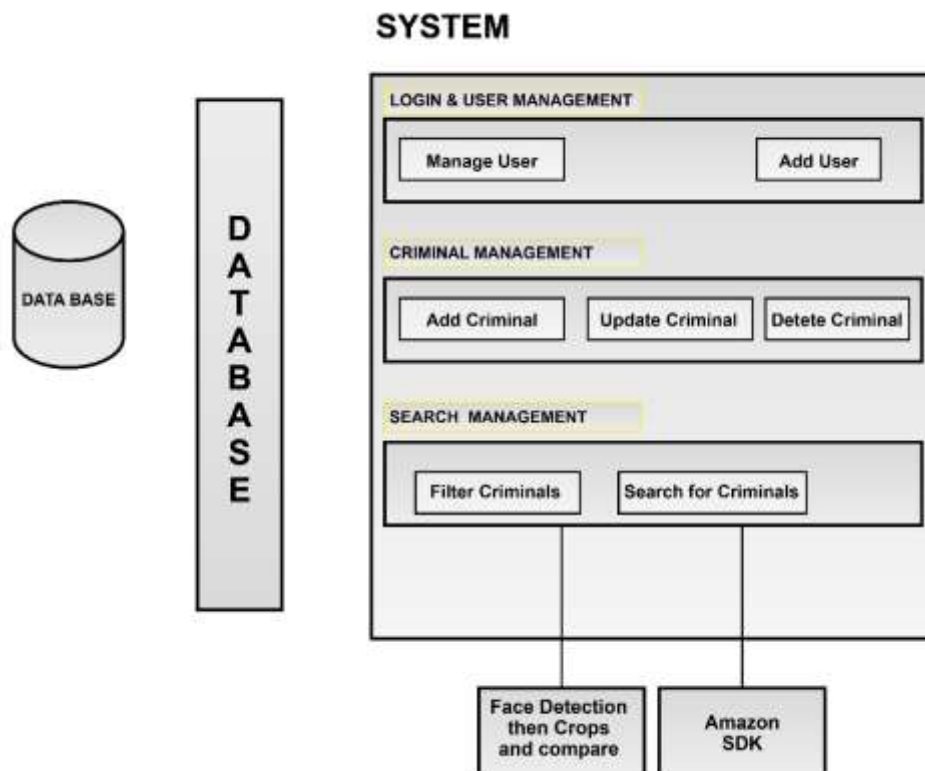


*Figure 4System block diagram*

**System Flow Chart**
As illustrated in Figure 5 the admin or cops can search for any criminal by logging in to the system and enter the criminal info or add his/her image, the admin or cops can search for another criminal or can finish the search process.
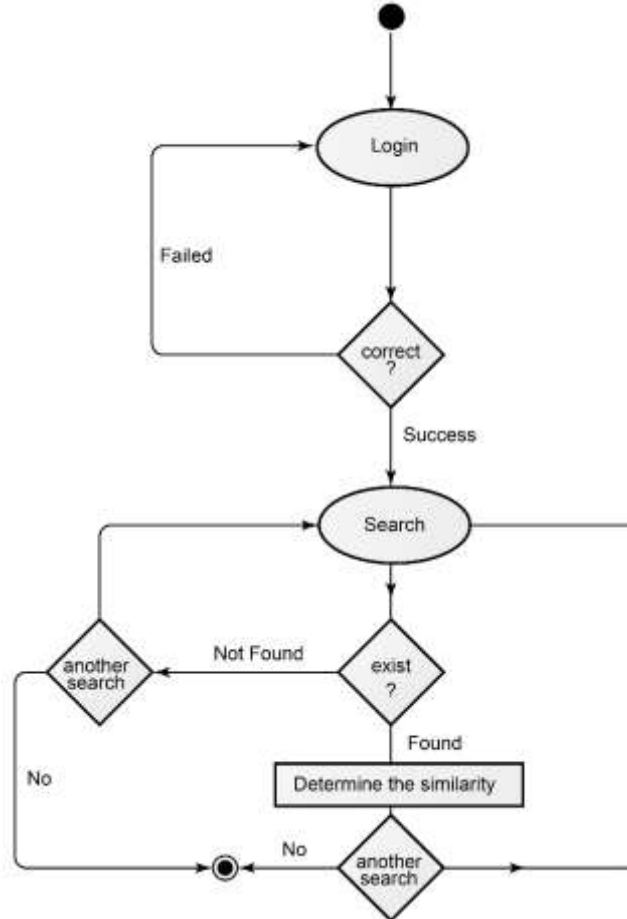
INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT



*Figure 5 System Flow Chart*

**ER Diagram**
ERD is developed to show the entities present in a database as well as the relationship between tables in that database. Figure 6 shows the ER diagram for CIDS database
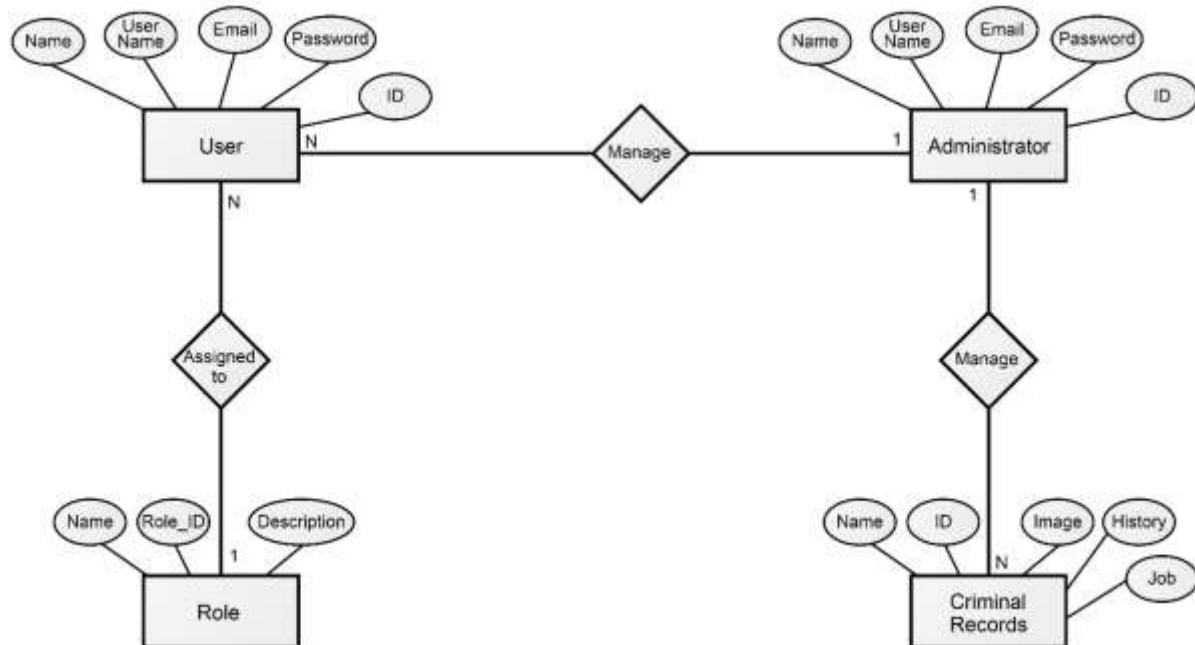
*Figure 6 ERD of the System.*

Finally, the actual tables that are built in the database are Administrator, Users, Criminal Records. These table are built in a database called **newcriminal.sql**.

**System Implementation**

**Tools**
The first step in successfully executing the work is to understand the problem that needed to be solved. The Authors need to design a web application that can accept an image and match this image with criminal records in the database. To do this task, firstly the language and database that will be used should be decided. PHP language and MySQL database will be used in this task. PHP being the server side programming language and MYSQL an open source relational database management system. When combined together will capable of delivering highly unique solutions. One of the main reasons for choosing both PHP and MYSQL Application Development is the simplicity and ease of use. Besides this PHP has a big developer community that can extend their hands at any time you require. PHP also has several open source content management program like WordPress, Joomla, Drupal,… etc. Along with various open source alternatives for ecommerce development like Os Commerce, Magento, Joomla, ...etc. to create robust ecommerce online stores with boundless products and services.

In addition to, PHP is very cost-effective and never cost an extra dime. With a free license, you can be sure that no one will ask you to pay extra after developing the website. It is worth knowing that Apache/PHP/MYSQL combo runs perfectly well on a low cost, low end hardware that you can ever imagine for ISS/ASP/SQL Server.

**PHP**
Installing PHP on the development PC allows you to safely create and test a web application without affecting the data or systems on live website. To create, run, and debug the PHP system the following softwares are needed:

- **A web server:** Typically, development and debugging is performed on a local web server, while the production environment is located on a remote web server. The current version enables using a local server. PHP support can be added to a number of web servers (IIS, Xitami,….,.) but most commonly Apache HTTP Server is used.
- The PHP engine.

- **A database server:** Various database servers could be used, while one of the most popular ones is the MySQL server.

The required software could be down loaded from the following sites:
1. Download PHP at www.php.net/
2. Download Apache at http://www.apache.org/
3. Download MySQL at http://www.mysql.com/

**All-in-One packages**
To avoid all these such burden, the authors use all-in-one-package. There are some excellent all-in-one Windows distributions that contain Apache, PHP, MySQL and other applications in a single installation file, e.g. laragon, XAMPP, and Wamp Server.

Laragon package is selected for the CIDS implementation since it is lighter and save the memory consuming. Latest version could be downloaded from here http://www.laragon.org/.

Laragon:
The face recognition website will be built locally. Laragon tool will be used to do local development. Laragon tool is stable, fast, and support various features. It has many versions; these versions can be downloaded from https://laragon.org/. Version with the following softwares, Apache 2.4, Nginx, MySQL 5.7, PHP 7.2 and Node.js 8,are downloaded to and used in developing PHP web site. Figure 7 shows the laragon tool after installation on local computer, the apache server, and MySQL server are also loaded.
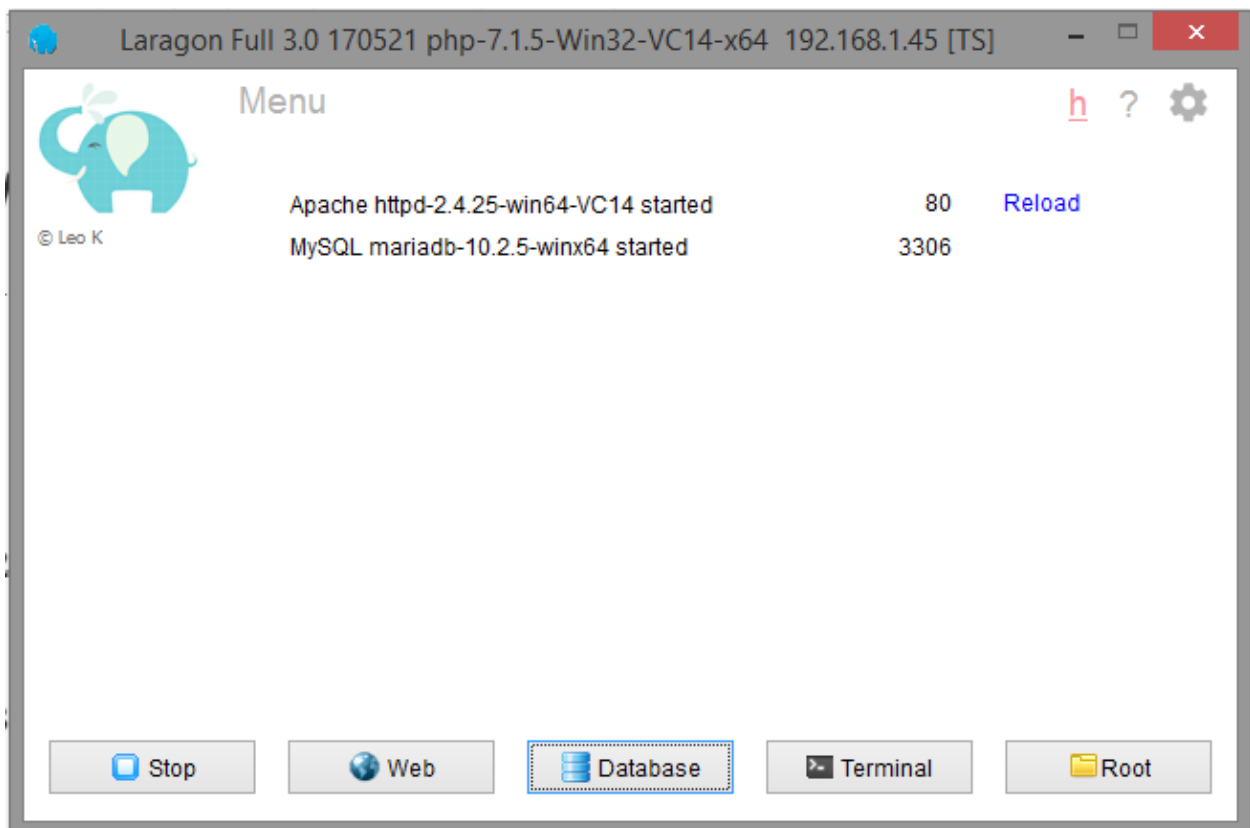


*Figure 7 Laragon Interface*

INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

*PHP My Admin:*
To control MYSQL database the interface PHPMyAdmin is used. This interface is downloaded from https://www.phpmyadmin.net/downloads. Then the folder that downloaded is renamed to phpmyadmin folder and putted inside folder C:\laragon\etc\apps.

*Amazon Rekognition:*
In the CIDS system, the Amazon Rekognition web service is used to compare criminals faces against a criminals images database. AmazonRekognition is based on the same proven, highly scalable, deep learning technology developed by Amazon's computer vision scientists to analyze billions of images and videos daily—and requires no machine learning expertise to use. Amazon Rekognition includes a simple, easy-to-use API that can quickly analyze any image or video file that is stored in Amazon S3. Amazon Rekognition is always learning from new data as new labels and facial recognition features are continually added to the service.

*Web site design:*
The web site is designed based on some ready templates. A related images are added to the interface as illustrated in the Figure 8 that shows the main interface of the website.



*Figure 8 Main Interface of the System*

The functions that exist in face recognition web site is added as a dropdown list as in the Figure 9

*Figure 9 Admin Functions on the System*

**Adjust Website design to PHP programming**
To adjust the web design to be inserted in the PHP development, the page is divided into header, tail and content to reduce repetition of the code. The general layout of the pages is shown in Figure 10.
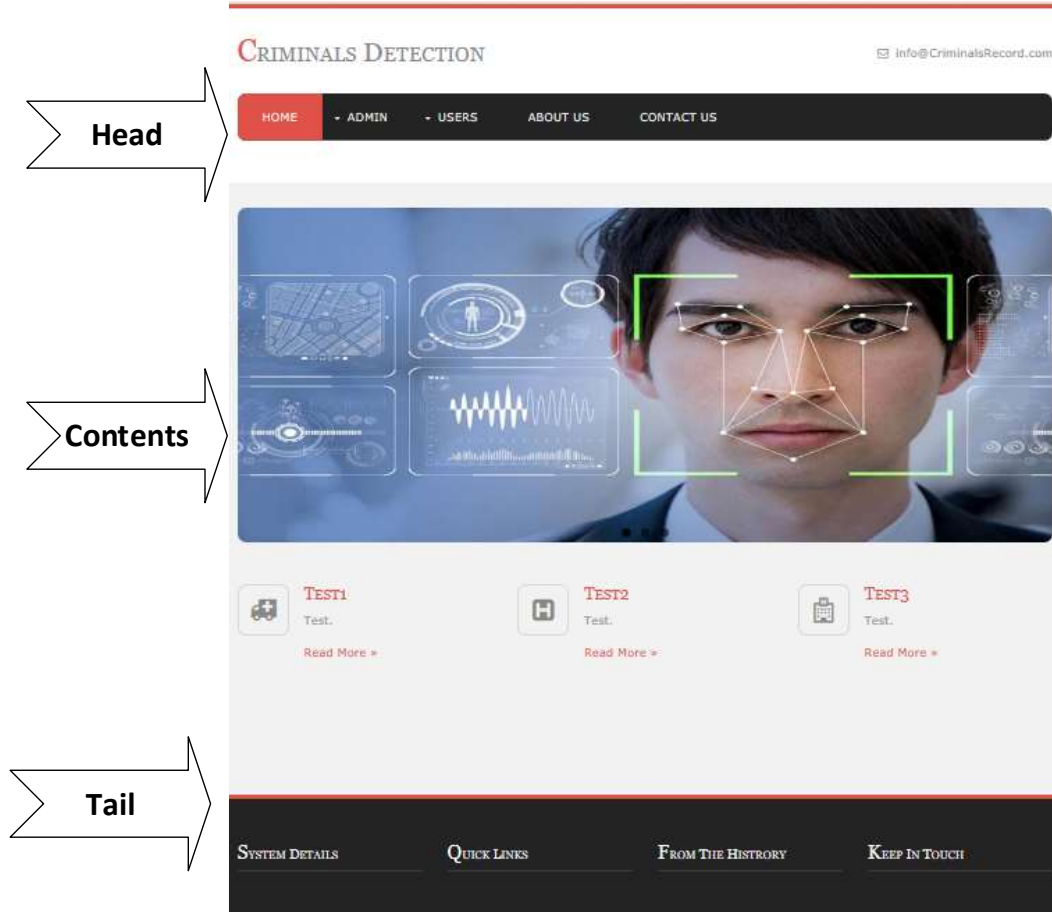
INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT



*Figure 10The general layout of the Design*

**Database Connection**
For CIDS ,it is required to establish a MySQL connection as illustrated in figure 11by using PHP .By connecting to a MySQL table , retrieving the results and displaying them back on the web page will be done. The information that will be needed to connect to the MySQL database is MySQL server address, username(root), password('') and database name (newcriminal).The data of database connection will be encapsulated in file DBConnect.php, then this file will be included in each php file to connect and retrieve data from database. The file contents can be shown in Figure 12

INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT
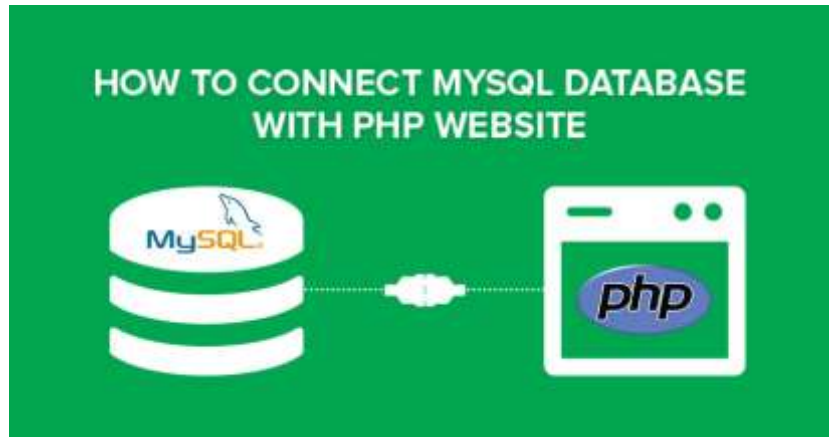


*Figure 11 DBConnect.php file to connect PHP with MySQL*

```php
<?php

        classDBConnect

{

private $server = "mysql:host=localhost;dbname=newcriminal";

private $user = "root";

private $pass = "";


private $options = array(

PDO::ATTR_ERRMODE => PDO::ERRMODE_EXCEPTION,

PDO::ATTR_DEFAULT_FETCH_MODE => PDO::FETCH_ASSOC

);


protected $con;

/* Function for opening connection */

public function openConnection()

{
```

*Figure 12 Connection Between PHP and MYSQL Database*

**Development**
To deliver the CIDS new system ,it is requiredto develop it. In the first stage the login process is designed. In the proposed system there are two login forms, one for admin and the other for users (cops). Admin is logged to the
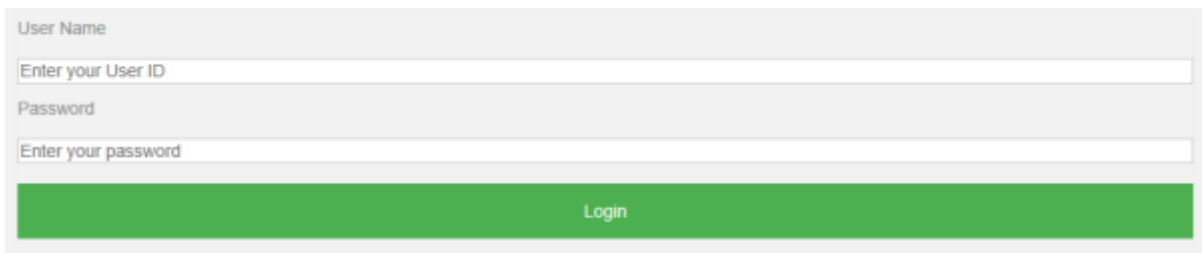
---

INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

system to manage users (cops), criminal records, and also search for criminals. In contrast, users can only search for criminals, update criminals' records, and update their profiles.

***Login:***
***Admin Login***
The admin login need the user name and password, the system check the validation against empty fields then check the data in the database to match the inserted data form in Figure 13 with existing data in database. A sessions containing id and the name of admin is created.
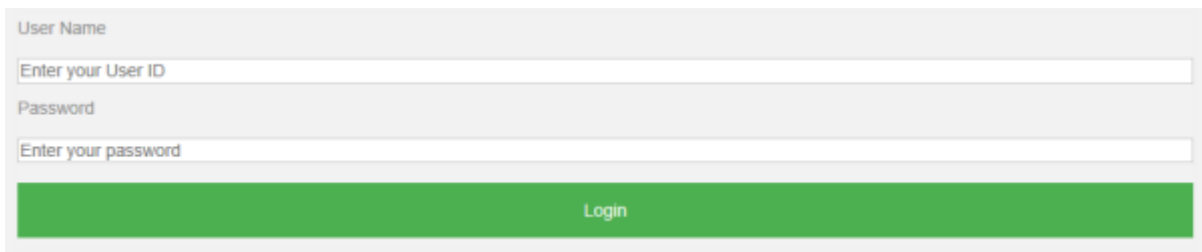


*Figure 13 Admin Login*

***User Login***
Same thing for users login .Figure 14 shows only change in the table (users) that match the data.



*Figure 14 User Login*

The second phase of the implementation after login phase is the Admins and members functions. This functions can be summarized as follows:

***Manage Users:***
All users (cops) data can be managed by the admin. A page containing all users data and a facility to update or delete users is designed as shown in Figure 15.



*Figure 15 Manage Users*

INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

Also by using the add user link the site transfer to the add user page as shown in Figure 16. The admin can assign a different roles to the users.



*Figure 16 Add User (Cops)*

This user data is inserted in the database in table users. The link update shows the current user data in a form like the insert form as shown in Figure 17



*Figure 17 Update User*

The data for the current user (distinguished by ID in table users) is updated by the new data. Finally, in the management of user, the admin can delete any user by deleting link of the user from database.

INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

**Manage Criminals**
To manage the criminal records, a page with list of criminals is created. All of criminals is listed with update and delete links. Also there is an Add Criminal link to add a criminal record to the database. This page is illustrated in Figure 18



*Figure 18 Manage Criminals*

To add criminal record go to the following form shown in Figure 19 in which the name, job, history and an image of the criminal is required. The image is stored in the database as a binary data.



*Figure 19 Add Criminal*

---

INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

The update page that comes from the update link contains a form filled by the current criminal that admin need to update. If the admin doesn't add a new page, then the system keeps the old image of the criminal without any update. Figure 20 shows the update form of the criminals.



*Figure 20 Update Criminal*

### Results and discussion

Admin and user (cop) can search in the criminals records by three ways (Name, Jobs, Image). For instances, the user uploading an image then the system searches the matching of this image in the database (under implementation) as illustrated in Figure 21



*Figure 21Criminal Search*

The proposed system suggests two ways to apply face recognition: either using a ready tool (amazon rekognition), or the developed tools.

The amazon recognition tool is an API receive two images by uploading them to its server and make a compare between two faces in the two images. This tool is a commercial tool, also the images must be uploaded to its servers. This technique may be harmful for the security idea of the CIDS system, since the images must be private for the police sector. Based on these obstacles the authors decided to design a simple tool for face recognition.

INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

The tool is dependent on the following steps:
1. Detect the face in the searched image, and all images in the database.
2. Crops all these faces and store them in another images.
3. Compare the new images that contains only the faces to detect the similarity.
4. Finally choose the searched image and give the results.

There are three ways to search for criminals. Name, Job or Image. The main way in the proposed system is to search by image using face recognition technique. Based on the results, the system successfully retrieves the criminals data that matches the searching image as illustrated in Figure 22
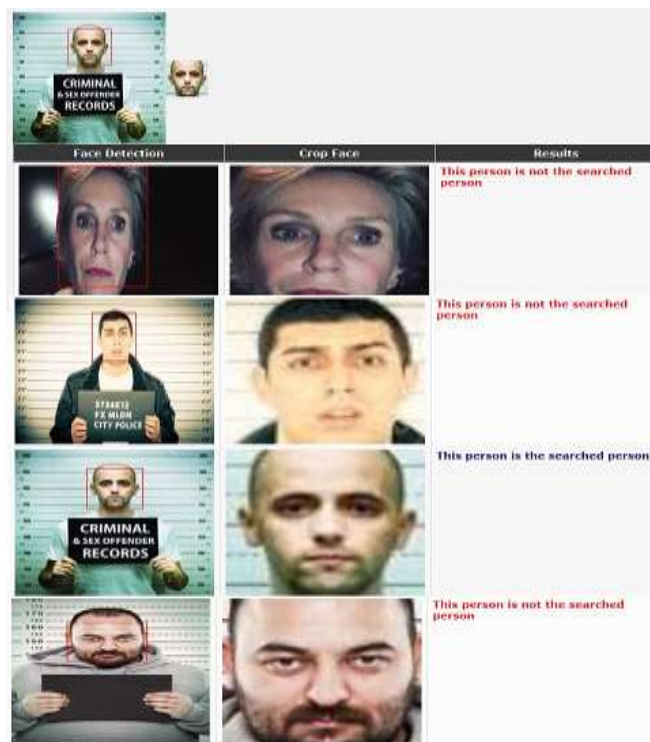


*Figure 22 Search by image results*

As the results show, the system detects all faces in the database besides the face that inserted for search. The detected faces will be  cut , saved and shown in the interface. Finally, these cutting faces are comparing to detect the face that cops search for it. This method gives a great result, also it gives the cops a new chance to search manually by cutting the faces and showing it on the interface. However, this method Suffer a little from its inability to deal with changing in face Profiles for criminals.

## Conclusion
The system CIDS is designed and implemented through this paper. It was explained  to show its functionality and power in details. It works on decreasing the crimes in the society by identify criminals from their faces, in addition to some other features like managing criminals records by adding, deleting and updating. Also managing access roles are added to the system. The future work will be mainly based on enhancing the proposed face recognition tool to be flexible with changing in face profiles. This paper presents flexible method for face recognition which could be developed to be used for cars, products, goods or any other pattern recognition.

## References
[1] Decohomeart,[19Mar2018] http://www.decohomeart.co/.

# INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT

[2]  Yali Amit, Donald Geman, and Kenneth Wilder ,Joint, Induction of Shape Features and Tree Classifiers.
[3]  Hsuan Yang Dan Roth Narendra Ahuja, ASNoW-Based Face Detector Ming.
[4]  Samaria, F. S. (1995), Face recognition using Hidden Markov Models (doctoral thesis).
[5]  A. N. Rajagopalan, K. Sunil Kumar, Jayashree Karlekar, R. Manivasakan, M. Milind Patil, U. B. Desai, P. G. Poonacha and S. Chaudhuri, Finding Faces in Photographs.
[6]  H. Rowley, S. Baluja, and T .Kanade . Rotation invariant neural network-based face detection. In Proceedings of the IEEE Computer Society Conference on Computer Vision and Pattern Recognition,
[7]  Paul Viola and Michael Jones ,Robust Real-time Face Detection Compaq Cambridge Research Laboratory.
[8]  Lay-Khoon Lee and Siau-Chuin Liew, A Survey of Medical Image Processing Tools,.
[9]  Medical Image Processing, Analysis and Visualization in clinical research.
[10] Elias N. Malamas, Euripides G.M. Petrakis2 , MichalisZervakis,A Survey on industrialVision  Systems and Application.
[11] Y.Srinivas2,J.V.R.Murthy,Criminal  Identification  System  Based  on  Facial  Recognition  Using Generalized Gaussian Mixture Model.
[12] Divyarajsinh N. Parmar1 , Brijesh B. Mehta2,.Face Recognition Methods & Applications
[13] Face Recognition: A Survey Shailaja A Patil1 and Dr. P. J. Deore2.
[14] Criminal  Face  Recognition  System  •  Alireza  Chevelwalla,  Ajay  Gurav,  Sachin  Desai. W. H. R. Fernando, C. Karunaratne, M. L. D. M Vimukthi, S. Saneek, H.T.K. Atapattu and C. Jayawardena, Criminal Identification System Using Face Recognition & Fingerprint. Identification
[15] Michel Owayjan, Amer Dergham, Gerges Haber, Nidal Fakih, Ahmad Hamoush, ElieAbdo, Face Recognition Security System