BIOMETRIC VERIFICATION SYSTEM FOR CRIME CONTROL

(A CASE STUDY OF NIGERIAN POLICE FORCE (NPF))

BY

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BEING A PROJECT WORK SUBMITTED TO THE DEPARTMENT OF COMPUTER SCIENCE, SCHOOL OF

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NOVEMBER, 2022.

CERTIFICATION

We, the undersigned, certify that this project work was carried out by **ALIU MICHEAL FRIDAY** with Mat. No: **ICT/2252030327** of the Department of Computer Science.

We also certify that the work is adequate in scope and quality in partial Fulfillment of the requirements for the award of Higher National Diploma (HND) in Computer Science.

_____   _____

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_____   _____

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Head, Department of Computer Science

DEDICATION

This project is dedicated to God Almighty, for HIS LOVE and GRACE in my life.

ACKNOWLEDGEMENT

It gives me great pleasure to express my gratitude to Almighty God for aiding me to accomplish the task he sets before me and to those who in special measures have aided me in this project.

Special thanks to my supervisor DR. CHETE F.C. it is a privilege being your project student may you live long and the HOD, Mr. Akhetuamen, S. O. for his support , activities and guidance. I appreciate you sir may your day be long and the efforts of my lecturers in Computer Science department for imparting knowledge into me GOD bless you all.

A million thanks goes to my family, my wife MICHEAL PROMISE FRIDAY for her support and advice, my parent MR/MRS ALIU FRIDAY and the entire family for their moral and financial support. I will not forget to appreciate my guardian MR/MRS IKPINIMA for their special support in my life and academics and those dear to my heart who directly and indirectly aided in the completion of this work. Thank you all. God bless you.

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ABSTRACT

Crime control is a major obligation of the Nigerian Police Force. There is the need to keep a proper record of crimes committed in the past so as to prevent further crimes in the future. However, the record keeping of the Nigerian Police Force is done manually which makes it difficult to merge or trace cases from one station to the other. This research is about Biometric Verification System for Crime Control with a case study of the Nigerian Police Force looks into these challenges by capturing any suspect and cases using the fingerprint capture. This would ensure uniformity of records across each station and help to prevent the occurrence of future crimes. The system is designed using the Object-Oriented Methodology and programmed using Visual Basic and Microsoft Access as the database.

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Crime is any act committed in order to violate the law. There is no part of the world that crime does not exist be it serious or a minor case. Peer pressure, illicit drug usage, corrupt political background, religious sentiments, bigotry, society, unemployment, deprivation, unfair judicial system are the common factors that brings about crime. The types of crimes in most society are; fraud, hate crime, arson, burglary, rape/sexual assault, robbery, murder, modern slavery, manslaughter, stalking and many more. However, what is disturbing is that security agencies who are supposed to be a cure to crime are overpowered by it. In order to reduce the rate of crimes, crime investigation should be done and culprits should be made to face suffer the consequent of their act. Criminal investigation can be done by conducting search, interrogate witnesses, collection of forensic evidences, interview victims, and other various methods of investigation. (Okeke & Forster, 2021)

The traditional and age-old system of intelligence and crime record maintenance has failed to live up to the requirements of the existing crime

scenario. Manual processes neither provide accurate, reliable and comprehensive data round the clock nor does it help in trend prediction and decision support. It also results in lower productivity and ineffective utilization of manpower. The solution to this ever-increasing problem lies in the effective use of Information Technology. Crime Tracking Information System uses computer-generated records as an interface for integrating and accessing massive amounts of location-based information. Akabeli (2017)

In this computer age, investigation of crimes is done using technologies commonly known as forensic science. Applying biometric in crime detection and investigation in various security agencies in Nigeria will help tame the rate of crime, capture criminal using their biometric data and also put an end to the innocent individual who are punished for the crime they did not commit in the country. (Okeke & Forster, 2021)

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1.2 STATEMENT OF THE PROBLEM

Currently, various security agencies in Nigeria still use the manual or tradition approach for crime investigation and detection that has the following challenges;

i. Referencing existing crime records is usually difficult because of the manual system of documentation or relatively impossible.

ii. It is usually difficult to trace the exact case file number of the last recorded case due to the ambiguous quantity of data, it has resulted in duplicates of Case File Numbers due to the form of case file number generation and compilation.

iii. Paper records are sometimes damaged by pest, fire outbreak or even water and can also be altered by an unauthorized user.

iv. Time and dates in case files and records may be inaccurate thereby making references to them cumbersome and uneasy.

v. It is not easy to search for case file because of the non-system form of case file arrangements.

vi. Misplacement of files and forensic evidence by staff gotten from crime scenes.

1.3   AIM AND OBJECTIVES OF THE STUDY

The aim of this study is to develop a Biometric Verification System for Crime Control (a case study of Nigerian Police Force (NPF)) with the following objectives:

i. Easing the difficulties faced when making references to existing crimes cases and records using a flexible search algorithm.

ii. Easily generating random case filing numbers for ambiguous records and make cases to be traced without stress, and also put a stop to duplicates in Case File Numbers.

iii. Storing records into a database for cases to be easily accessible even if the manual (paper documentations) get damaged by pest, fire, water etc.

iv. Creating a time/date stamps in case files and records so that referencing will not be difficult.

v. Keeping safe and securing criminal files and forensic evidences which might have been misplaced or stolen by storing them into an approved database.

1.4   SIGNIFICANCE OF THE STUDY

The study will be of great help to the Nigerian Police Force in tracing and stopping crimes in Nigeria. This study is also an eye-opener for future researcher to make reference for further studies on the subject.

1.5   SCOPE OF THE STUDY

This study covers the investigation and review of several literatures related to the study on biometric crime detection in the Nigeria Police Force. It also covers a detailed design of a workable system using Visual Basic Programming Language.

1.6   LIMITATIONS OF THE STUDY

Some limitations were encountered during this project design which includes the following:

i.   **Time constraints**: Due to time constraint the program implementation and testing were phase was made shorter.

ii.   **Financial constraints**: Due to financial constraints some processes were limited.

1.7   DEFINITION OF TERMS

i. **False non-match rate (FNMR), also called FRR (False Reject Rate)**: is the certainty that the system has failed to recognize a match between the input pattern and a matching database template. It measures the percent of valid inputs that are incorrectly rejected.

ii. **FMR (False Match Rates), or False Accept Rate (FAR):** It is a probability via which the system does not correctly match input patterns to a non-matching database template. It calculates the rate of failed inputs that are incorrectly accepted.

iii. Failure **to enroll rate (FTE or FER)**: is the rate at which an attempt to create templates from input is not successful. It is commonly caused by a poor quality inputs.

iv. **Failure to capture rate (FTC)**: is a probability that the system has failure in detecting an individual's biometric input even when presented correctly.

v. **Capacity of Template**: is the maximum amount of biometric of data stored in the system.

vi. **Face Recognition**: these are biometrics tools that captures and recognizes individual's faces. Face recognition biometrics are commonly found in new generation smart phones, security vault and doors of big organizations

CHAPTER TWO

LITERATURE REVIEW

2.1   AN OVERVIEW OF BIOMETRIC USED IN SECURITY SYSTEMS

The ability to measure and analyze the behavioral features (signature, voice, gait) and biological (physiological and anatomical) characteristics (fingerprint, palm geometry, pattern of iris, retina) constitutes biometrics. Biometric technologies use these features as medium of identifying individuals, thus biometrics is not what we have but who we are (Arshad, Hayat, & Khan, 2015). Identity recognition and verification credentials such as passwords and tokens are usually forgotten and stolen, however biometrics identification is the individual and cannot be lost or forgotten (Gupta, 2015). This paper seeks to investigate future trends of biometric applications in border management under four categories; biometrics in mobile devices that authenticate and verify individuals, secondly identity management and biometrics in the cloud, thirdly recent biometric technologies that is meant to collect individual data clandestinely for the purposes of security among others and fourthly big data analytics stratagems that can predict high risk/low risk travelers. Consequently, the challenges and security lapses that confront current and future of biometric technologies are explored. The future prospects of biometric devices and its related technology as well as strategies that can be enhanced to control the risk

and security threat today, is a critical terrorism combat tool to be appreciated (Adey, 2012; Arshad et al., 2015).

Biometric technology and predictive big data analytics used in thwarting security threat are individually expected to benefit individuals, the society and the general public as well as any nation. Nevertheless, the future risk and benefits associated with biometric and big data technologies to relevant stakeholders' raises concerns and anxiety. In this era of heightened security threats and increasingly growing terrorist attacks, identity dominance is imperative to deter perpetrators as well as harnessing security awareness (Ashbourn, 2014). Biometric simulated technologies and predictive data analytics seems to be one of the appropriate solutions to terrorism and its related crimes in the world today. There is no doubt biometrics will continue to advance with various attributes to curb terrorism and have dominance in identification of criminals. It is expected that biometrics used in border management and in various industries will increase exponentially as the cost associated with its implementation drops (Salawadgi, 2014). It has become the main identification tool used by law enforcement agencies and criminal justice setup to establish the match for unknown assailant of crimes and accordingly protecting society.

The adoption of biometric passports has become common phenomenon in this era. The recent terrorist attack in France and Brussel airport which caused

the death of many and left many also injured was a challenge to these countries involved. However, the apprehension of perpetrators was possible due to their biometric data that was available to authorities at the time (Friedland, 2016; Quadri & Quadri, 2016).

2.2 COMPONENTS OF A TYPICAL BIOMETRIC SYSTEM

A typical biometric authentication system consists of five modules/components.

Sensor module: It is used to capture user's raw biometric data. An example is camera used to take a picture of human face.

Feature extraction module: It is used to process the acquired biometric data to extract a set of features. For example, features on the surface of a face, such as the contour of the eye sockets, nose, and chin can be extracted.

Matcher module: It is used to compute matching scores of comparing the extracted features against the stored ones.

System database module: It is used to store the biometric templates of features the enrolled users.

Decision-making module: It is used to either determine the user's identity or confirm the users claimed identity (Amin et al., 2015).

2.3   TYPES OF BIOMETRIC

Fingerprint

Biometric fingerprint identification is most popular method for person identification. Fingerprint has been widely used in business transaction. Fingerprints consist of a regular texture pattern composed of ridges and valleys. These ridges are characterized by several landmarks points, recognized as minutiae, which are typically in the form of ridge endings and ridge bifurcations. The spatial distribution of these details points is maintain to be unique to each finer, it is the collection of minutia points in a fingerprint that is primarily employed for matching two fingerprints. Since all government agencies and institution used automatic fingerprint identification system. Materialization of low cost and compact fingerprint readers has made fingerprint modality a preferred choice in many civil and commercial applications (Jain & Kumar, 2010).

FACE

Face acknowledgment may be a nonintrusive procedure, and facial pictures range unit without a doubt the principal basic biometric trademark utilized by people to shape a private acknowledgment. The uses of personality check shift from a static, controlled "mug-shot" confirmation to a dynamic, uncontrolled face recognizable proof amid an untidy foundation (e.g., air

terminal). 1) the situation and form of facial attributes like the eyes, eyebrows, nose, lips and chin, and their abstraction relationships, 2) the (global) analysis of the face image that represents a face as a weighted combination of variety of canonical faces. While the verification performance of the face recognition systems that are commercially on the market is affordable, they impose variety of restrictions on however the facial images are obtained, generally requiring a set and simple background or special enlightenment (Anil, 2014).

IRIS

The iris pattern is taken by a special grey scale camera in the distance of 10-40 cm of camera. One time the grey scale picture of the eye is obtained then the program tries to locate the iris within the picture. Iris recognition is a computerized system of biometric identification that makes use of mathematical path recognition method. Iris images get under infrared illumination consist of complex texture pattern with numerous individual attributes, e.g. stripes, pits, & furrows, which permit for highly reliable personal identification. The visual texture of iris is formed in the work of fetal development & becomes stable in first years itself. Iris recognition is also widely used; it is feasible in huge scale. Each iris is different for twins like finger print. It is difficult to alter iris pattern & it is simple to detect the artificial iris. The main advantages of iris recognition are high accuracy & verification time's takes less than seconds. The

disadvantage of this recognition are cost is high, much movement of head & use of color contact lens. Conversely, high sensor cost, along with comparatively huge failure to enroll (FTE) rate reported in some studies, & lack of legacy iris databases may limit its usage in some large-scale government applications (Alamurugan, 2014).

PALM GEOMETRY

The palmprint and hand geometry unadulterated arithmetic pictures may be separated from a hand picture in an exceptionally single shot at indistinguishable time. Distinctive multi-biometrics frameworks (e.g., face and unique mark, voice and face and so forth.), a client doesn't have to hold up under the impairment of going through numerous sensors. Moreover, the extortion identified with imagine hand, close by geometry based for the most part check framework, may be satisfied with the mix of palmprint components. Each obtained pictures should be adjusted in a favored course in order to catch the same components for coordinating. The picture thresholding operation is utilized to acquire a twofold hand-shape picture. The edge quality is more than once figured utilizing Otsu's strategy. The hand geometry frameworks have huge physical size and can't be effortlessly installed in existing security frameworks (Kumar et al., 2014).

2.4   ADVANTAGES OF BIOMETRIC SYSTEM

The first advantage of using this new technology is the uniqueness and it is also the main characteristic which allows biometrics technology to become more and more important in our lives. With uniqueness of biometrics technology, each individual's identification will be single most effective users makes this technology less prone for users to share access to highly sensitive data. For example, users can share their fingerprints, iris and so forth allowing other users access to secure information. Each trait used during identification is a single property of that user. In other words, it is extremely hard or impossible to make duplicate or share biometrics accessing data with other users. This makes it ever more secure allowing user information and data to be kept highly secure from unauthorized users. This identification of users though biometrics cannot be lost, stolen or forgotten. This aspect of biometrics technology allows it to become more popular in its use. This method of identifying and giving access to user makes user identification a lot easier. Finally, most biometrics security systems are easy to install and it requires small amount of funding for equipment (except modern biometrics technology such as: DNA/retinal/iris recognition (Tistarelli, 2009). identification for that user. A chance of two users having the same identification in the biometrics security technology system is nearly zero. The highly secure way of identifying users makes this technology less prone for

users to share access to highly sensitive data. For example, users can share their fingerprints, iris and so forth allowing other users access to secure information. Each trait used during identification is a single property of that user. In other words, it is extremely hard or impossible to make duplicate or share biometrics accessing data with other users. This makes it ever more secure allowing user information and data to be kept highly secure from unauthorized users. This identification of users though biometrics cannot be lost, stolen or forgotten. This aspect of biometrics technology allows it to become more popular in its use. This method of identifying and giving access to user makes user identification a lot easier. Finally, most biometrics security systems are easy to install and it requires small amount of funding for equipment (except modern biometrics technology such as: DNA/retinal/iris recognition (Tistarelli, 2009).

2.5   DISADVANTAGES OF BIOMETRIC SYSTEM

Jain (2006) it still has many fault in its system. Each biometrics application method has disadvantage which can cause problems for its users. For example, if the biometrics security system uses fingerprints to identify its users and an accident causes a user to lose his/her finger then it can be a problem during the verification process. For voice recognition methods, illnesses such as strep throat can make it hard for authorized users to get access to their

information. Another factor that can influence voice recognition systems is the continuous aging of its users. Noise in an environment where voice recognition is used to identify its users can also make it hard for users to be identified. For iris or retinal scanning applications, users may find it very intrusive. Users may also have the concern for the safety of their eyes during the iris or retinal scan. Furthermore, databases used to store user identification data will be very large which might form a potential threat. For scanning retinal/iris characteristics and storing large amount of database, biometrics system requires new and modern technology. Therefore, the cost for equipment is also expensive. Finally, lots of people are still concerned about biometrics technology in different aspects such as: security, adaptability to rate of change in life, scalability, accuracy, privacy and others (Jain et al., 2016).

2.6   BIOMETRICS IN IDENTITY MANAGEMENT

Identity management and control happens to be one of vital components in tackling information security issues. It is encompassed by previously known access control concept, nevertheless things seem to be changing. Audit trail which use to be a core function of identity management and was used to investigate unlawful access and various breeches in respective organizations have taken another trend which is more of a mechanism for gathering intelligence (Adey, 2012). In this age of information explosion any information

is critical and vital, It is for this reason that the kind of information gathered for identity management purposes are done circumspectly so that it can be used for various intendment as and when needed (Adey, 2012; Jain & Kumar, 2012).Which is why the use of biometrics in recent times is not only to verify and authenticate individuals but also serves as a system that accumulate data for intelligence purposes among others with current emergence of data analytic technologies. Most cyber criminals and terrorists are successfully apprehended by security agencies as a result of availability of data on them. However, the exponential growth in data and storage devices with its corresponding usage in large scale systems, currently at most secured places, is a challenge to these available identity management systems. Consequently, the competence of identity management devices in the near future is a question that is being a concern to many researchers, with the rate at which data is growing relatively. The emergence of cloud computing and big data analytics in that respect, to handle large volumes of data seems to be a consolation to these fears. Current research envisaged that advanced algorithms for analytics purposes would be available to process large volumes of data in real-time. Could this really help boost security in any given country or society against terrorism or would it also be challenged by hackers, which is why information security research would have to

be an ongoing phenomenon (Ashbourn, 2014b; Baesens, 2014; De Marco, Kechadi, & Ferrucci, 2014)

The Australian government initiated changes in legislation so as to be able to collect a plethora more of biometric data from foreigners as well as citizens. Furthermore, the department of immigration and citizenship with the help of IBM came up with a border risk identification system which relies on big data mechanism to decimate high risk and low risk travelers by correlating patterns contracted by the big data tools (Ajana, 2015; Oostveen, Kaufmann, Krempel, & Grasemann, 2014).The Uk border security Authority for instant have intalled CCTV cameras at various entry points that analyse and compares with existing details in a database of the faces of travelers for possible identification of a wanted individual or 'risky persons' (Ajana, 2015).

2.7   REVIEW OF RELATED WORKS

According to Krishna, Dr. & Talukdar, Fazal & Laskar, Rabul. (2013). Study on Biometric Authentication Systems, Challenges and Future Trends: A Review. The authors wrote that when authenticating users into a computer system, different forms of security such as pin, password, access cards, barcode etc. are used. The increase in technology has led to the misuse, fraud and theft of the above mentioned security measures. This led to invention of biometric

security systems by which authentications can be done using and individual biometric data or template. They also discussed on the future of biometrics.

Sharma, Abhilash. (2015). Biometric System- A Review. International Journal of Computer Science and Information Technologies. 6. 4616-4619. The author talked about biometrics becoming the most popular technology and due to its liability. It is very easy to use and handle. Biometric System review is provided in this paper is provided. The main steps involve in biometrics is: Image Formation, Image Processing and Image Matching .

Abdalrahman, Roaya & Bolat, Bülent & Kahraman, Nihan. (2018). A cascaded voice biometric system. Procedia Computer Science. This paper presents a voice biometric system which uses both text dependent and independent speaker and speech recognition methods. Mel Frequency Cepstral Coefficients (MFCC) and pitch period are used as features and the decision is made by using Euclidian distance metric. This cascaded procedure reduces the False Positive Rate and increases the security of biometric recognition system. It is shown that cascaded system defines voice recognition better in terms of accuracy, safety and difficulty of penetration. The efficiency of the identification system is high up to approximately 91.2% .

Sakila, A. & Vijayarani, S. (2019). A Survey on Facial Recognition. International Journal of Computer Sciences and Engineering. Duraibi,

Salahaldeen & Sheldon, Frederick & Alhamdani, Wasim. (2020). Voice Biometric Identity Authentication Model for IoT Devices. International Journal of Security, Privacy and Trust Management. Bokade, Gayatri & Kanphade, Rajendra. (2019). Secure Multimodal Biometric Authentication Using Face, Palmprint and Ear: A Feature Level Fusion Approach.The author reviewed that without a certified personality identity, and also there is no certainty of right, or no civil liberty Dahan M., et al (2015). One can claim her right, like refusing to be identified only the individual is a prominent person. Danilov, Valery & Grushko, Yaroslav. (2019). Comparison of the effectiveness of machine learning classifiers in the context of voice biometrics. System research and information technologies. .

In cryptosystem biometric, correction of error code techniques are applied to handle intra-class variations Feng,Y. C. et al 1st March 2010) [11]. Falaye, A., N.V. Adama, and F.P. Agemerien. (2013) the author made a research on "Design and implementation of Crime Investigation System using Biometric Approach (Nigerian Police Force)". Pacific Journal of Science and Technology the author developed a crime investigation system using on fingerprint to investigate crimes.

CHAPTER THREE

SYSTEM ANALYSIS AND DESIGN

3.1 DESCRIPTION OF THE EXISTING SYSTEM

The existing system involves a complainant going to the nearest police station to report crime committed to him or others in his environment. This method often requires that files are manually opened to store the complaint. The police then on getting this information make efforts for the arrest of the suspect to be interrogated. All these data will be written in the record book and kept in the archives. When the suspect is arrested he/she might be detained in the counter or cell as the case may be, while the divisional crime officer assigns an investigating police officer (IPO) the investigation to be conducted. Bailing as the case may be, maybe granted to the suspect depending on the seriousness of the case. If bail is granted the suspect will be expected to report to the police station on a daily bases whenever needed. When the investigation has been concluded, the details of the investigation will be documented on the crime diary booklet by the investigating police officer, and then the suspect will be charged and arrayed in the court where the judge will hear and give the final verdict. The suspect or accused will be referred to as a criminal if after the court hearing the suspect is found guilty.

One can categorize crimes depending on the related punishment, with sentencing tariffs prescribed in line with the perceived seriousness of the offence. Thus fines and noncustodial sentences may address the crimes seen as least serious, with lengthy imprisonment or (in some jurisdictions) capital punishment reserved for the most serious. The following classes of offences are used, or have been used, as legal terms of art:

i. Offence against the person

ii. Violent offence

iii. Sexual offence

iv. Offence against property

Researchers and commentators have classified crimes into the following categories, in addition to those above:

i. Forgery, impersonation and cheating

ii. Firearms and offensive weapons

iii. Offences against the State/Offences against the Crown and Government Political offences

iv. Harmful or dangerous drugs

v. Offences against religion and public worship

vi. Offences against public justice Offences against the administration of public justice

vii.   Public order offence

viii.   Commerce, financial markets and insolvency

ix.   Offences against public morals and public policy

x.   Motor vehicle offences

xi.   Conspiracy, incitement and attempt to commit crime

xii.   Inchoate offence

xiii.   Juvenile Delinquency

3.2   DRAWBACKS OF THE EXISTING SYSTEM

Due to the manual means being used by the Nigerian police force, in keeping information about crime and entering records of it into record books instead of it being in form of data input into computer storage system, problems arise and there problems have plagued the Nigerian police force and affected the policing system in the country. Some of these problems are enumerated below.

(a) Insufficient Equipment Almost all police units in the country lack equipment such as computer system. If these systems are provided, there will be good report generated, communication links among different police units (when networked) and this in-turn will enhance decision Making and ultimately facilitate the fighting of crime because good and valuable information yield's good results.

(b) Keeping Of Record Books For Different Cases That Come In Daily.

This presents a lot of problems to the policing system because the record books are always voluminous and in trying to keep all these, some vital information might be lost. This also makes the office look very clumsy and untidy since most files are covered with dust.

(c) Loss of Important Information

Due to damages that occur on record books and files, when pages are lost, some vital information is also lost

(d) Inaccuracy

Due to the manual method of handling information a lot of human error are noticed in processed information.

(e) Time lapses

Due to the manual method, there is always a slow response- time when the law court requires information about particular cases.

(f) Insecurity

There can be no proper security of information.

3.3   JUSTIFICATION FOR THE NEW SYSTEM

The new system will help sanitize crime detection in Nigeria. The software will be of immense benefit to government. The software will among other things:

1. Facilitate crime detection

2. Information management

3.4 DATA COLLECTION METHOD AND INSTRUMENTS

The following research methods were used for study:

1. **Interview**

   This was done between the researcher and some of the officers of the Nigerian Police in Force at the Jattu Police Station in Auchi Edo State. Information on criminal charges and trial was gathered.

2. Reference to Written Text:

Reference was also made to some existing documents and case files in the police station. Some materials were also downloaded from internet for the purpose of reviewing the work.

3.5 OVERVIEW OF THE PROPOSED SYSTEM

This system is designed to accommodate only one category of user which is the administrator. The administrator can register suspect / crime, update crime records, delete crime case and change password.

The system is designed using the object oriented notations which is the use case diagrams which shows the role played by the various actor of the system. In this case the administrator The case diagram is presented below:
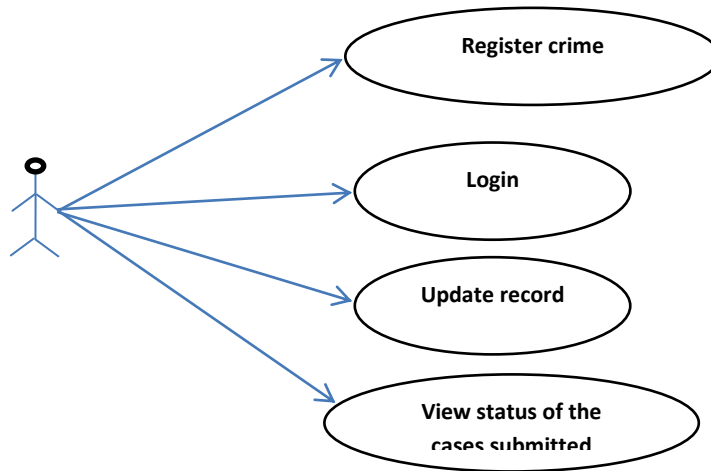

Fig. 3.1 Use case diagrams of the system

3.6   BENEFITS OF THE PROPOSED SYSTEM

The proposed system will solve most of the problems that the existing system encompasses. This web based system will make the crime cases to be process faster and it will also save a lot of time and energy. The main benefits are:

1. The complainant will not need to wait for a long time to know the decision of the police as the status of the case would be updated online and viewed by the complainant instantly from their homes.

2. It will ensure that cases that require urgent attention are handled more quickly as priority is attached to each case.

3. Less chance of the manipulation of information as records cannot go missing.

4. The management will get up-to-date report which will help them indecision making.

3.7   INPUT AND OUTPUT DESIGN

The input of the system is designed in forms. The forms are filled then submitted into the database for storage. Some of these inputs are the user registration form, login form, file cases form etc.

The outputs of the system are in the form of html tables. The tables are data pulled out from the database which were earlier stored.

3.8   DATABASE DEFINITIONS

The database consists of four relational tables designed to relate with each other using the primary and foreign keys. The tables are defined below as follows:

User Table

user_idint(11) NOT NULL,

username varchar(200) NOT NULL,

password varchar(200) NOT NULL,

address (200) NOT NULL,

state (200) NOT NULL,

marital (200) NOT NULL,

status (200) NOT NULL,

Admin table

Admin_id (100) NOT NULL,

Username varchar(25) NOT NULL,

Password varchar(25) NOT NULL,

first_name varchar(200) NOT NULL,

last_name varchar(200) NOT NULL,

email varchar(200) NOT NULL,

desig varchar(200) NOT NULL,

role varchar(220) NOT NULL

Cases table

Case_id varchar(200) NOT NULL,

Case_details varchar(200) NOT NULL,

User_id varchar(200) NOT NULL,

Staff_id (50) NOT NULL,

Image varchar(50) NOT NULL,

Docum varchar(200) NOT NULL,

clint(200) NOT NULL,

sclint(200) NOT NULL,

elint(200) NOT NULL

Police table

Police_id (100) NOT NULL,

Username varchar(25) NOT NULL,

Password varchar(25) NOT NULL,

first_name varchar(200) NOT NULL,

last_name varchar(200) NOT NULL,

email varchar(200) NOT NULL,

desig varchar(200) NOT NULL,

role varchar(220) NOT NULL,
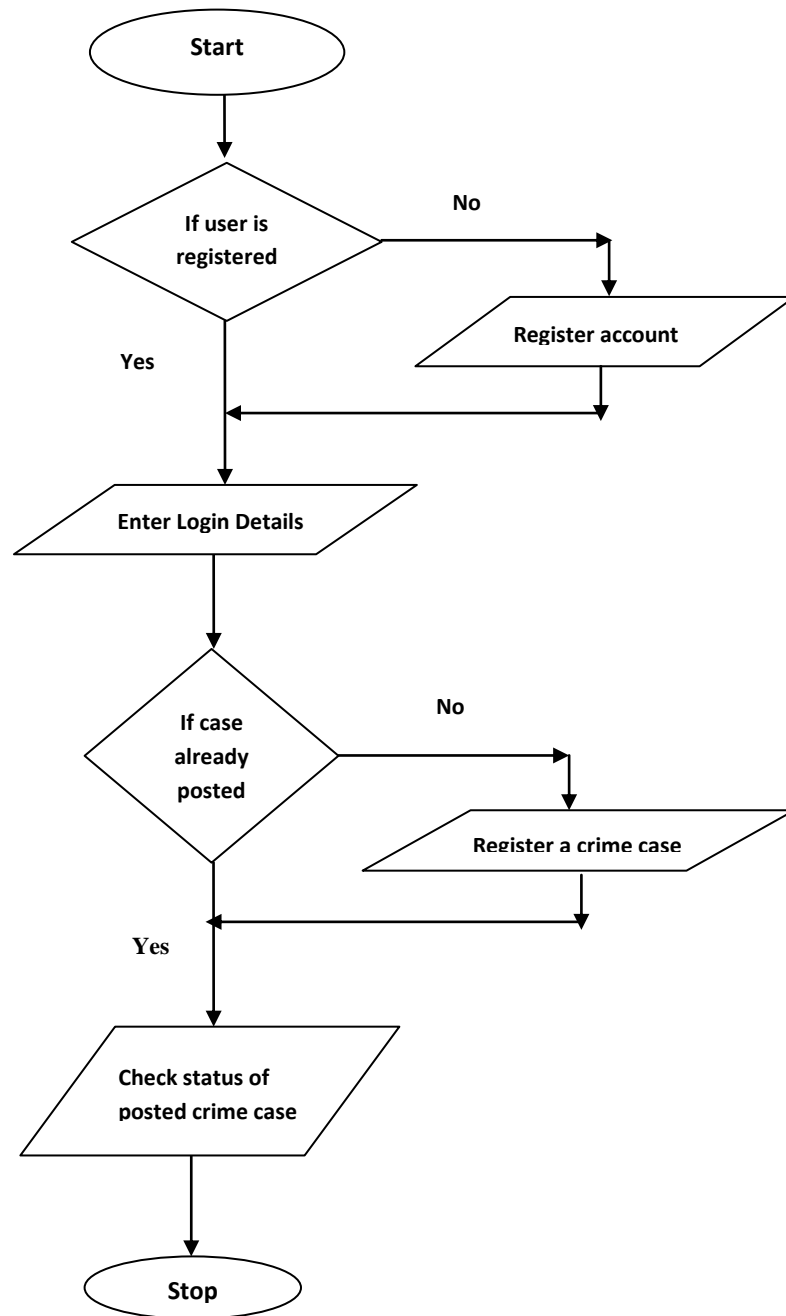
status varchar(220) NOT NULL

3.9   SYSTEM FLOWCHART

Fig. 3.2 Flowchart of the system

CHAPTER FOUR

SYSTEM IMPLEMENTATION

4.1   CHOICE OF PROGRAMMING LANGUAGES

Visual Basic or VB is an easy to use programming language designed for beginners. It allows you to easily develop GUI window applications which are used to create windows and dialogue boxes for display on a windows system. It is the software tool that easily works with the biometric device. This is the tool used in this research.

4.2   SYSTEM REQUIREMENT

System requirement are those things, needed for the efficient working of the new system. These include:

i.   Software Requirement

ii.   Hard Requirement

4.2.1 SOFTWARE REQUIREMENT

Software refers to a set of program that is executable by the computer to perform a task. Software requirement are those software that are required by the new system for its effective function.

i.   Windows XP operating system is most preferable for the new system to function.

ii.   Web browser like Mozilla Firefox, Internet Explorer, Google Chrome etc.

iii. PHP (HyperText Preprocessor) for executing scripts.

iv.   CSS (Cascading Style Sheet) for formatting the output of the website.

v.   MySQL database to store the data.

4.2.2 HARD WARE REQUIREMENT

Hardware refers to the physical component of the computer. This houses the software, the combinations of hardware and software is vital for the effective running of the new system that was designed for transcript management. The hardware requirements that are needed for the effective running of the new system are stipulated below as follows:

i.   Monitor (VGA, SVGA or LCD)

ii.   Keyboard

iii. Pentium IV

iv.   Server

v.   LAN Network

4.3   PROGRAM INTERFACE

Homepage: The homepage is the first page to be accessed from the system. It stands as a boundary for unauthorized users who have no login credentials into the system.
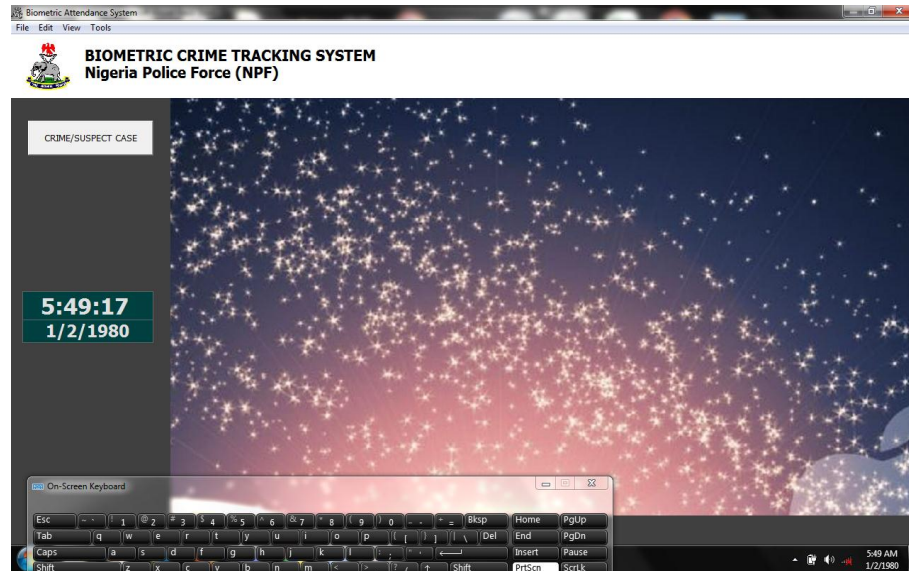
4.1 Home Page of the Website

Login Page: This page is where all registered complainant needs to go to login into the system so as to either post details about a crime or check the status of an already registered crime.
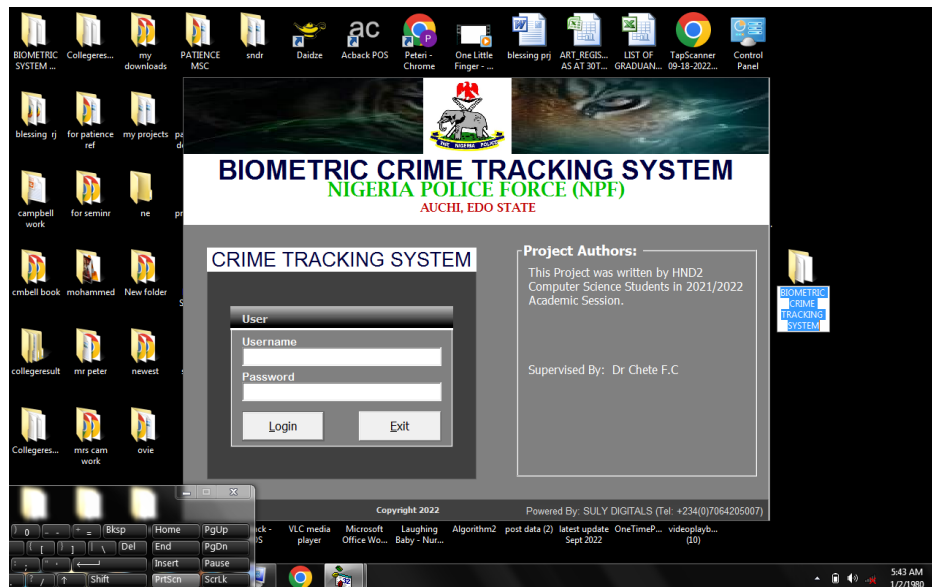
4.2 Login Page of the Website

Case registration page: This page allows the complainant to post the complaint to be view by the police officer in charge.

4.3 Cases interface

Case history page: This module is used to view any outstanding cases posted by the users of the system. The ones that have been solved and the ones pending as well.

4.3 Cases interface

4.4   TESTING

Testing shows the presence of bug (error) within a program debugging is used to identify the case of these bugs. After correcting the bugs, we then use test data to check if the program was working according to specification. The programmer in accordance with the design objective supplied the test data used for the program. Testing was first performed individually by testing all the modules independently using the appropriate test data. After all the modules were tested and found to be working properly, the entire program was now tested as a whole (one unit). Also test data was supplied and database was updated, so that reports could be printed. Hence, I can conclusively say that the program was properly tested and is reliable.

ERRORS ENCOUNTERED DURING TESTING

i.   **Error in Redirecting**: During the design of the login page for the user of the web application it was discovered that whenever the Adnin tries to login the web page always redirect to the login page. The error code snippet is shown below:

```
   ..
switch ($role) {
case "1":
        $_SESSION['username']= $username;
header("location:admin.php");
```

```
break;
        }
..
```

It was eventually detected that on the swich command used the case 1 which is for the Admin has a session variable initialized to the username and the others were not. The correct code snippet is illustrated below with the added code highlighted:

```
…
switch ($role) {
case "2":
```
<mark>$_SESSION['username']= $username;</mark>
```
header("location:admin.php");
break;
        } …
```

ii. **Error in Updating Password:** After initial login for the admin they are required to change their password. After filling the form and submitting the system was discovered not to update their password although it gives a positive out that the password was updated. The code snippet shows below:

```
    case 'password':
echo "</br></br>";
        echo "<p><center><font color='green' size='5'>Password is successfully
        updated!</font></center></p>";
break;
```

It was later discovered that the webpage omitted a function call that checks the new password and checks if it correspond with the confirmed password and if it also existed in the database before updating. The corrected code snippet indicated below with the added function highlighted:

```
case 'password':
echo "</br></br>";
include(checkpass.php);
echo "<p><center><font color='green' size='5'>Password is successfully updated!</font></center></p>";
break;
```

In summary, this prototype software has passed through:

1. **Module Testing**: Testing of individual program module

2. **Integration Testing**: Groups of program (modules) tested together to determine if they interface properly. This was done incrementally as the programs were being developed until the entire program system was tested.

3. **System Testing**: The testing of the complete set of application software. In a nutshell, this software was developed and tested on a Desktop Computer with an Intel Duo Core processor, running at 2.8MHz clock speed. It has a color monitor and 512MB of Random Access Memory (RAM).

4.5   CHANGE-OVER PROCEDURE

After the users are trained about the computerized system, working has to shift from manual system to the computerized. The following two strategies can be followed for running the system. These strategies are deemed fit because they do not immediately abandon the previous working system but enable them to run side by side so as to determine the effectiveness of the new system and in the case of modifications in the design.

1. **Parallel Run:** In such run for a certain defined period both systems i.e., computerized and manual are executed in parallel. This strategy is helpful because of the following:

(a) Manual result can be compare with the result of the computerized system.

(b) Failure of the computerized system at the early stage does not affect the working of the organization, because the manual system continues to work as it used to do.

2. **Pilot Run:** In this type of run the new system is installed in parts. Some part of the new system is installed first and executed successfully for considerable period of time. When the results are found satisfactory, then any other parts are implemented. This strategy builds the confidence and errors are traced easily.

RECOMMENDED PROCEDURE

The pilot run is the recommended method for the implementation of the system. This is a more economical method for the organization can do the conversion for as long a period as it deem fit. This also allows the organization to computerize the organization unit by unit.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 SUMMARY

During the course of this research it was observed that technology has and can play a big role in tracking crime in the society as being done in some advance countries. However, the use of information technology in tracking crime in the Nigerian Police Force is quite underutilized. Hence, a software design was made which would be accessible online by both the public and the police officers in order to properly manage crime in the society.

5.2 CONCLUSION

The benefits of information technology in combating crimes are very numerous as we live in an IT era. The software developed can go a long way in helping the police get instant information of crimes happening in their neighborhood. This will also provide relief to the public who can lodge complaints at the comfort of their homes even using their mobile devices.

5.3 RECOMMENDATIONS

The following are my recommendations for the research:

i.   It is recommended that the Nigerian police force be adequately trained

on the use of Information Technology in crime tracking. Computer literacy program should be organized for the Nigerian police. This can be carried out set by set.

ii.   At the end of the training, it is recommended that the crime tracking system be deployed to every police station for recording crime information.

iii. Government should invest into buying of computer equipment for the police for a better service delivery.

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APPENDIX
SOURCE CODE LIST

```
Option Explicit

Dim WithEvents Capture As DPFPCapture
Dim CreateFtrs As DPFPFeatureExtraction
Dim CreateTempl As DPFPEnrollment
Dim ConvertSample As DPFPSampleConversion
Dim counter As Integer
Dim blob() As Byte
    Dim Templ As DPFPTemplate
Private Sub DrawPicture(ByVal Pict As IPictureDisp)
' Must use hidden PictureBox to easily resize picture.
 Set HiddenPict.Picture = Pict
 Picture1.PaintPicture HiddenPict.Picture, _
     0, 0, Picture1.ScaleWidth, _
     Picture1.ScaleHeight, _
     0, 0, HiddenPict.ScaleWidth, _
     HiddenPict.ScaleHeight, vbSrcCopy
 Picture1.Picture = Picture1.Image
End Sub
Private Sub ReportStatus(ByVal str As String)
' Add string to list box.
 Status.AddItem (str)
' Move list box selection down.
 Status.ListIndex = Status.NewIndex
End Sub


Private Sub Close_Click()
On Error Resume Next
' Stop capture operation. This code is optional.
 Capture.StopCapture
'Unload frmRegistration
 Unload Me
'frmReg.Show vbModal
End Sub

Private Sub cmdBack_Click()
On Error Resume Next
   Unload Me
   frmRegistration.Show vbModal
End Sub

Private Sub cmdCapture_Click()
   Set Capture = New DPFPCapture
   Capture.StartCapture
   Set CreateFtrs = New DPFPFeatureExtraction
   Set CreateTempl = New DPFPEnrollment
   Samples.Caption = CreateTempl.FeaturesNeeded
   Set ConvertSample = New DPFPSampleConversion

End Sub
```

```vba
Private Sub cmdLeftThumb_Click()
    Set Capture = New DPFPCapture
    Capture.StartCapture
    Set CreateFtrs = New DPFPFeatureExtraction
    Set CreateTempl = New DPFPEnrollment
    Samples.Caption = CreateTempl.FeaturesNeeded
    Set ConvertSample = New DPFPSampleConversion
End Sub

Private Sub cmdLeftIndex_Click()
    Set Capture = New DPFPCapture
    Capture.StartCapture
    Set CreateFtrs = New DPFPFeatureExtraction
    Set CreateTempl = New DPFPEnrollment
    Samples.Caption = CreateTempl.FeaturesNeeded
    Set ConvertSample = New DPFPSampleConversion
End Sub

Private Sub cmdRightThumb_Click()
    Set Capture = New DPFPCapture
    Capture.StartCapture
    Set CreateFtrs = New DPFPFeatureExtraction
    Set CreateTempl = New DPFPEnrollment
    Samples.Caption = CreateTempl.FeaturesNeeded
    Set ConvertSample = New DPFPSampleConversion
End Sub

Private Sub cmdRightIndex_Click()
    Set Capture = New DPFPCapture
    Capture.StartCapture
    Set CreateFtrs = New DPFPFeatureExtraction
    Set CreateTempl = New DPFPEnrollment
    Samples.Caption = CreateTempl.FeaturesNeeded
    Set ConvertSample = New DPFPSampleConversion
End Sub

Private Sub cmdSubmit_Click()
On Error GoTo ErrH
    Dim strNIN As String, strName As String, strAge As Integer, strStatus As String, strGender As
String
    Dim strPhone As String, strAddress As String, strState As String, strLGA As String, strVillage As
String, strPassport As String
    Dim strExt() As String, strPath As String, strPhoto As String, ext As String

    strPhoto = "": strPath = "": ext = ""


    If Templ Is Nothing Then
        MsgBox "No Fingerprint has been Captured", vbExclamation + vbInformation, "No Capture"
        Exit Sub
    Else
        If Trim(frmRegistration.txtFileName.Text) <> Empty Then
            strExt = Split(frmRegistration.txtFileName.Text, ".")
            ext = strExt(UBound(strExt))
            strPath = App.Path & "/passports/" & Format(Date, "yymmddhhnnss") & "." & ext
```

```vb
        strPhoto = "passports/" & Format(Date, "yymmddhhnnss") & "." & ext
        FileCopy frmRegistration.txtFileName.Text, strPath
End If


strNIN = StrConv(frmRegistration.txt(0).Text, vbUpperCase)
strName = StrConv(frmRegistration.txt(1).Text, vbUpperCase)
strAge = CInt(frmRegistration.txt(2).Text)
strPhone = StrConv(frmRegistration.txt(3).Text, vbUpperCase)
strState = StrConv(frmRegistration.txt(4).Text, vbUpperCase)
strLGA = StrConv(frmRegistration.txt(5).Text, vbUpperCase)
strVillage = StrConv(frmRegistration.txt(6).Text, vbUpperCase)
strAddress = StrConv(frmRegistration.txt(7).Text, vbUpperCase)
strGender = StrConv(frmRegistration.cbo(8).Text, vbUpperCase)
strStatus = StrConv(frmRegistration.cbo(9).Text, vbUpperCase)
'strPassport = strPhoto


' Export template to binary data.
blob = Templ.Serialize

"""""""""""connect to database here
Set db = OpenDatabase(gsDatabase)
Set rs = db.OpenRecordset("SELECT*FROM suspects WHERE nin='" & strNIN & "'")
With rs
    If .BOF Then
        .AddNew
            !nin = strNIN
            !FullName = strName
            !gender = strGender
            !age = strAge
            !maritalstatus = strStatus
            !phone = strPhone
            !homeaddress = strPhone
            !state = strState
            !lga = strLGA
            !village = strVillage
            If Trim(frmRegistration.txtFileName.Text) <> Empty Then
                !passport = strPhoto
            End If
            !fingerprint = blob
            !regdate = Format(Date, "dd/mm/yyyy")
        .Update
    Else
        .Edit
            !FullName = strName
            !gender = strGender
            !age = strAge
            !maritalstatus = strStatus
            !phone = strPhone
            !homeaddress = strPhone
            !state = strState
            !lga = strLGA
            !village = strVillage
            If Trim(frmRegistration.txtFileName.Text) <> Empty Then
                !passport = strPhoto
```

55

```vb
                End If
                !fingerprint = blob
                !regdate = Format(Date, "dd/mm/yyyy")
             .Update
          End If
          .Close
        End With
        db.Close
        MsgBox "RECORD/FINGERPRINT HAS BEEN ENROLLED!"
      Call Close_Click
    End If
ErrH:
Exit Sub
   MsgBox Err.Description, vbCritical, "Error"
   Exit Sub
End Sub

Private Sub Form_Load()
   Set Capture = New DPFPCapture
   Capture.StartCapture
   Set CreateFtrs = New DPFPFeatureExtraction
   Set CreateTempl = New DPFPEnrollment
   Samples.Caption = CreateTempl.FeaturesNeeded
   Set ConvertSample = New DPFPSampleConversion

   Status.Clear
   ReportStatus ("==PLACE YOUR FINGERPRINT ON THE MACHINE==")
   Status.ListIndex = 0
 counter = 0
End Sub

Private Sub Capture_OnReaderConnect(ByVal ReaderSerNum As String)
 lblMsg.Caption = " Fingerprint Machine CONNECTED."
 lblMsg.ForeColor = &H8000&
End Sub

Private Sub Capture_OnReaderDisconnect(ByVal ReaderSerNum As String)
 lblMsg.Caption = " Fingerprint Machine DISCONNECTED."
 lblMsg.ForeColor = vbRed
End Sub

Private Sub Capture_OnSampleQuality(ByVal ReaderSerNum As String, ByVal Feedback As
DPFPCaptureFeedbackEnum)
   If Feedback = CaptureFeedbackGood Then
     ReportStatus ("***GOOD FINGERPRINT QUALITY***")
   End If
End Sub

Private Sub Capture_OnComplete(ByVal ReaderSerNum As String, ByVal Sample As Object)
 Dim Feedback As DPFPCaptureFeedbackEnum

 'If Feedback = CaptureFeedbackGood Then
   ' Draw fingerprint image.
   ' Process sample and create feature set for purpose of enrollment.
   Feedback = CreateFtrs.CreateFeatureSet(Sample, DataPurposeEnrollment)
```

```vb
    ' Quality of sample is not good enough to produce feature set.
    If Feedback = CaptureFeedbackGood Then
       If counter < 3 Then
          ReportStatus vbCrLf & ("REMOVE FINGER AND PLACE IT AGAIN")
          ReportStatus ("==================================") & vbCrLf & vbCrLf
       Else
          ReportStatus vbCrLf & ("FINGERPRINT CAPTURED SUCCESSFULLY!")
          ReportStatus ("==================================") & vbCrLf
       End If
        ' Add feature set to template.
      CreateTempl.AddFeatures CreateFtrs.FeatureSet
      ' Show number of samples needed to complete template.
      Samples.Caption = CreateTempl.FeaturesNeeded
      ' Check if template has been created.
      counter = counter + 1
      If CreateTempl.TemplateStatus = TemplateStatusTemplateReady Then
         DrawPicture ConvertSample.ConvertToPicture(Sample)
         'imgFinger(counter).Picture = Picture1.Picture

         SetTemplete CreateTempl.Template
         ' Template has been created, so stop capturing samples.
         Capture.StopCapture
         MsgBox "FINGERPRINT HAS BEEN CAPTURED!"
         cmdCapture.Enabled = False

         'If (counter = 0) Then
         '    cmdLeftThumb.Enabled = False
         'ElseIf (counter = 1) Then
         '    cmdLeftIndex.Enabled = False
         'ElseIf (counter = 2) Then
         '    cmdRightThumb.Enabled = False
         'ElseIf (counter = 3) Then
         '    cmdRightIndex.Enabled = False
         'End If
       End If
     End If
'End If
 End Sub


Public Function GetTemplate() As Object
 ' Template can be empty. If so, then returns Nothing.
 If Templ Is Nothing Then
    MsgBox "No Fingerprint has been Captured", vbExclamation + vbInformation, "No Capture"
    Exit Function
 Else
    Set GetTemplate = Templ
 End If
End Function

Public Sub SetTemplete(ByVal Template As Object)
 Set Templ = Template
End Sub
```

```vb
Option Explicit
Dim strMatno As String
Private Sub cmdCancel_Click()
    Unload Me
End Sub

Private Sub cmdDelete_Click()
On Error GoTo ErrH

    If Trim(txtMatno.Text) = Empty Then
        MsgBox "NIN/Voter Card/Driver Licence is required"
        txtMatno.SetFocus
        Exit Sub
    ElseIf Trim(DTPicker1.Value) = Empty Then
        MsgBox "Crime Date is required"
        Exit Sub
    Else
        """"""""""connect to database here
        Set db = OpenDatabase(gsDatabase)
        Set rs = db.OpenRecordset("SELECT * FROM verdicts WHERE nin='" & strMatno & "' AND
date_time='" & DTPicker1.Value & "'")
        With rs
          If Not .BOF Then
            If MsgBox("CONFIRM RECORD DELETE", vbYesNo + vbQuestion, "Confirm Delete") =
vbYes Then
                .Delete
                MsgBox "Crime Record has been DELETED Successfully!", vbInformation, "Deleted"
            End If
          Else
            MsgBox "Incorrect NIN/Voter Card/Driver Licence / Date or Record does not exists!",
vbExclamation + vbInformation, "No Match"
            Exit Sub
          End If
          .Close
        End With
        db.Close
    End If

Exit Sub
ErrH:
    MsgBox "ERROR: " & Err.Description, vbCritical, "Error"
    Exit Sub
End Sub
```