Development of Biometric- Based Crime Investigation System for the Nigeria Police Force, Ipaja, Lagos State, Nigeria

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ABSTRACT

It is worthy to note that security is the responsibility of all, and security of life and property is an essential need of an individual as well the society. This calls for the design of a well- organized police crime investigation system for effective delivery of their responsibilities to the public. Recognition of suspects is very important in the process of crime investigation. Owing to the efficacy of biometrics system of identification, most organizations and institutions still employ it for numerous purposes. This study therefore design and implement crime investigation system using finger print biometrics technology for the Nigerian Police Force at Ipaja, Lagos. C# programming language and SQL Server were used in the development of the software. Implementation of this criminal investigation system is recommended for Nigeria Police Station at Ipaja, Lagos and indeed for all other Nigerian Police Force Divisions in Nigeria .This process will not only eradicate the manual system but will also improve the process of investigation of criminal cases security , and process of securing the life and property of its will be strengthened.

Keywords: Security, Crime, Investigation, Investigation, Biometrics

1. INTRODUCTION

A crime occurs when someone breaks the law by an overt act, omission or neglect that can result in punishment. A person who has violated, law or has breached a rule, is said to have committed a criminal offense (CrimeAboutSystem, 2017).The crime investigation system is a computerized system for storage, analysis and retrieved of crime criminal records. Crime investigation is an applied science that involves the study of facts, used to identify, locate and prove the guilt of an accused person. A complete crime investigation can include searching, interviews, interrogations, evidence collection and preservation and various methods of investigation. Modern-day crime investigations commonly employ many modern scientific techniques known collectively as forensic science. Crime investigation is an ancient science that may have roots as far back as c. 1700 BCE in the writings of the Code of Hammurabi. In the code it is suggested that both the accuser and accused had the right to present evidence they collected. In the modern era crime investigations are most often done by government police forces. Private investigators are also commonly hired to complete or assist in crime investigations.

There is no free society; criminality is indeed part of human nature. Criminal behaviors in our society today tend to follows economic and social development. Therefore, according to Madden and Chiu, it is expected that, distribution of wealth and income is unevenly, tends causes upsurge in the frequency of crimes such as religious and ethnic clashes, motivated killings, the use of illegal weapons and armed robbery etc. Police are antidote to all forms of criminality , but , apparently. they get overwhelmed by crimes phenomenon (Sohnen, 2012). Crime investigation is usually time-consuming i.e traditional approach, this results to high cost due to a lots of inefficiency and delay. Whenever computers are used for crime investigation and and criminal record management , less time is spent on crime investigation and there would be   efficiency and accuracy in the process of investigation and its results. Biometrics embraces techniques such as handwriting and fingerprinting recognition for verification of identity using behavioral patterns and physical data .Biometrics as a technology is effective for crime prevention and has been widely used as a security measure for verification of identity and detection of crime (Sohnen, 2012).However, this paper therefore presents the design and implementation biometric- based computerized criminal investigation system for the Ipaja division of Nigerian Police Force. Lagos State.

1.1 Process of Crime Investigation

An officer will carry out an initial investigation, once a crime has been reported to the Nigeria Police Force (Alemika,2004).The following are stages of a police investigation, from the initial investigation when a crime is first reported, to the investigative assessment and then through to the three main outcomes as follows;

✓ **Initial Investigation**: This stage involves a review of scenes, witnesses, CCTV and all other available evidences such as any forensic samples and any relevant local knowledge. Following this the crime will be entered into the crime recording system (which is mostly manual-on paper) before the end of the officer's shift. The victim will then be issued with a crime reference number within 48 hours .

✓ **Investigative Assessment**: Crime Assessment Unit receives crime details for an investigative assessment to be completed. Thereafter, a decision will then be made whether to transfer the crime to an investigating officer for further investigation or not. This assessment will take into account the following:

        (i) How serious is the offence
        (ii) Likelihood of solvability (e.g. availability of evidence)

The victim receives phone call or SMS notifying them of the result of the assessment. There are two possible outcomes at this point.

I. **Closure of Investigation** -No proportionate leads to pursue. Should the NPF receive further intelligence or discover new evidence, which it regularly does, the investigation will be re-opened and you will be contacted. Regardless of whether this happens, the investigation that has been provided becomes a vital part of determining where and when to deploy police resources to detect and prevent crime.

II. **Further investigation:** An officer will be assigned for further investigation and he/she will be responsible for investigating the crime. This officer will be able to provide the victim with specific updates regarding the progress in the case. The method of contact and frequency of communication will be agreed with the victim by the investigating officer.

Officer carrying out further investigation does the following;

- Taking statements from the victim and any witnesses, which is a formal means of recording personal accounts of the crime.
- Arresting and detaining any identified suspects and formally interviewing them at a police station.

At the end of the investigation there are three main outcomes for the suspect(s).This is usually after conducting interviews, the suspect(s) may be bailed to return to the police station at a specified. The outcomes are; charged, cautioned or no further action. Historically, there has been the usage of manual method of handling criminal offences ; this system has been inefficient and is not result-oriented. Among the various problems being are encountered at the Ipaja Police station are inability to make reference to existing crime case because of documentation node which has been manual , file investigation is not easily located when needed in the station, files in the station are misplaced because of the cumbersome paper work, the identity of a real criminal can be faked in manual handling of crime investigation cases and also and data redundancy. This study therefore design and implement crime investigation system for Ipaja Police Station at Ipaja, Lagos.

1.2 Uses of Finger-Print for Crime Investigation System in Nigeria
Fingerprinting is one of the most important parts of a forensic investigation is. As fingerprints are unique to each individual, they serve as a highly accurate way for law enforcement agencies to identify a suspect, as well as potentially prove their guilt or innocence. It is necessary fo r s tudents in criminal justice degree programs to become familiar with the technique, as it is widely used in all forms of law enforcement. The objectives of the crime investigators may be more complex than people imagine, because of the changing nature of criminal activity and the role of the investigator.

Fingerprint can be used in Nigeria to achieve the following in crime investigations which includes:
• Prepare sound crime cases for prosecution
• Detect crime and locate and identify suspects in crimes
• Locate, document, and preserve evidence in crimes
• Arrest suspects in crimes
• Recover stolen property

People make mistakes while committing crimes that is the premise behind the crime investigation field. For example, a burglar may leave behind broken glass or clothing fibers, or a rapist may leave fingerprints, skin tissue, semen, or blood. As a result of these oversights, evidence of who they are is also left behind. It is the job of the crime investigator to know how, when, and where to look for such evidence. In doing so, he
Or she must be able to draw on various resources:
  •   Technological advances in evidence collection and preservation
  •   Their own training and experience in investigative techniques
  •   Witnesses and informants, for firsthand investigation about the crime
  All crimes require some degree of investigation. The extent to which any particular violation is investigated depends largely on resources available to the department and how the department prioritizes it.

Impression left by the friction ridges of a human finger is Fingerprint. The recovery of fingerprints from a crime scene is an important method of forensic. Fingerprints are easily deposited on suitable surfaces (such as glass or metal or polished stone) by the natural secretions of sweat from the ermine glands that are present in epidermal ridges. A print from the sole of the foot can also leave an impression of friction ridges. In a wider use of the term, fingerprints are the traces of an impression from the friction ridges of any part of a human or other primate hand. Fingerprint records normally contain impressions from the pad on the last joint of fingers and thumbs, although fingerprint cards also typically record portions of lower joint areas of the fingers. Deliberate impressions of fingerprints may be formed by ink or other substances transferred from the peaks of friction ridges on the skin to a relatively smooth surface such as a fingerprint card. Also, human fingerprints are, unique, detailed, difficult to alter, and durable over the life of an individual, making them suitable as long-term markers of human identity (Nelson & Sharma, 2011)

They may be employed by police or other authorities to identify individuals who wish to conceal their identity, or to identify people who are incapacitated or deceased and thus unable to identify themselves, as in the aftermath of a natural disaster. Fingerprint analysis, in use since the early 20th century, has led to many crimes being solved. many criminals consider gloves essential, this is what it implies.

1.3 Biometric Application in Crime Record System

Efficiency of Police Officers ,management of criminal records and proper monitoring of suspects will improve if a Crime Investigation Biometric –Based System is implemented. The system will specifically ensure the following; redundancies and inconsistencies will be reduced, user -defined rules for data integrity , data sharing across all applications, data authorization access. ,automatic data recovery and intelligent backup, and improvement on Integrity can be improved. This is according to (Hiew, B.Y., Teoh, A.B.J., and Pang, Y.H., 2007)

2. REVIEW OF RELATED WORKS

In (Douglas, 2006), who worked on Crime Classification Manual using crime signature method, he found out that some crime exhibits characteristics idiosyncratic to specific criminals, known as signature aspects, signature behaviours or signature characteristics. Where a Modus Operandi (MO) concerns the practical components of a crime which can also be unique to one suspect, signature aspects fulfil a psychological need and, unlike the MO, does not often change.

The two examples cited in Crime Classification Manual by John Douglas are a bank robber from Michigan who required tellers to undress during the robbery so he could photograph them, and a rape case where the perpetrator forced the husband to return home and be humiliated by the event. These characteristics move beyond modus operandi, because they fulfil a psychological need rather than a need of practical execution of the crime. The (Merlo & Rupert, 2006), who worked on Ohio Department of Rehabilitation and Correction using the system database to search for people who have been convicted in Ohio, and the investigation is usually about when a person is convicted, when the person was sentenced or fined, and when the person was released. He discovered that Ohio Department of Rehabilitation and Correction protects and supports Ohioans by ensuring that adult felony offenders are effectively supervised in environments that are safe, humane, and appropriately secure.
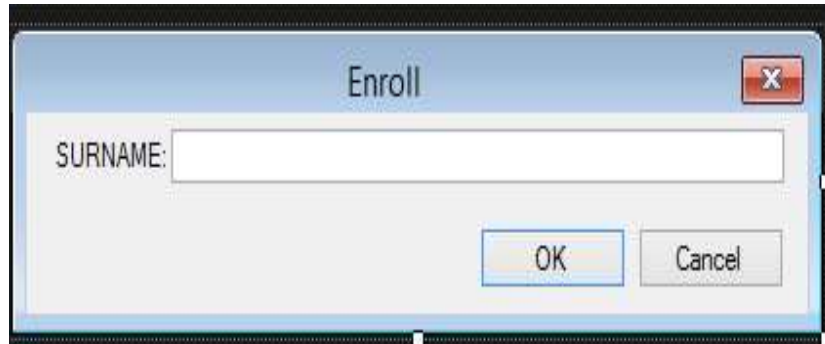
3. DESIGN OF THE SYSTEM

System design is a transition from a user-oriented document to a document oriented material by programmers or database personnel.System Design is the most creative part of the Programming. In this phase of Project design, flowcharts and pseudopodia are of great importance The system design is structured into the following parts:
- Input design
- Output design
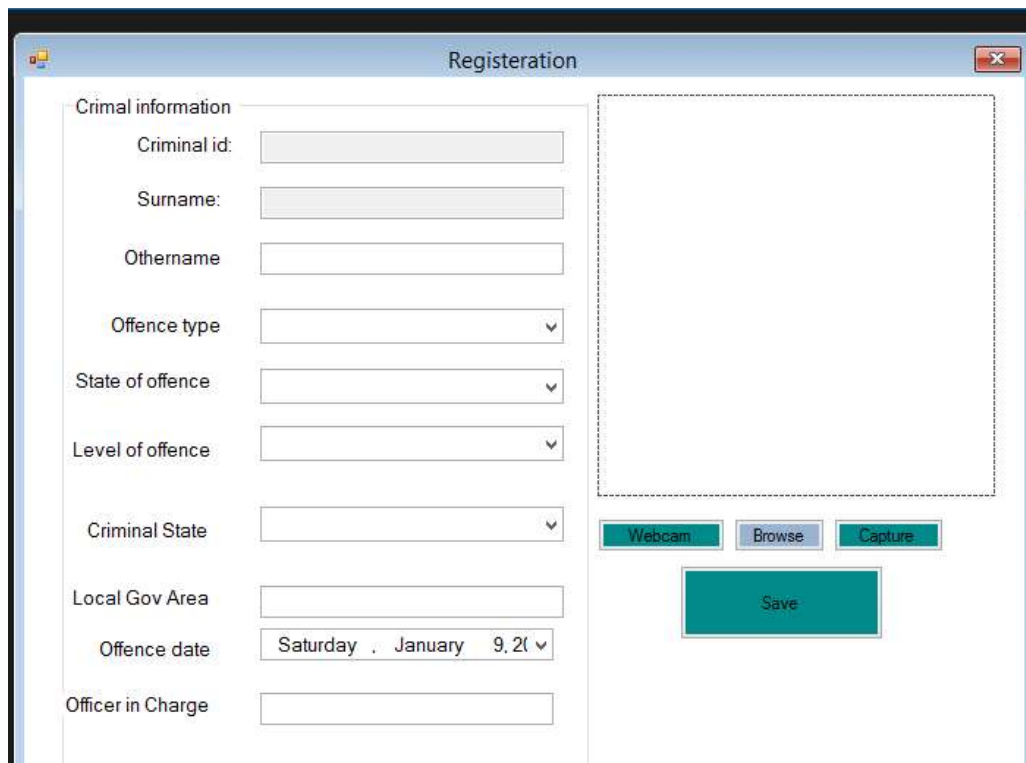- Database design
- Process design

3.1.1 Input design

Some of the available sections for registration purposes include: The Crime Investigation Register Page, finger print authentication, the update form and the fingerprint verification. Input design is an important part of development process since inaccurate input data are the most common cause of errors in data processing. A process of converting user originated inputs to a computer-based format. The following are the forms for capturing various data for the successful implementation of the crime investigation system;

Figure 1: Enrollment

Figure 2: Registration Form

Figure 3: Update Form

3.1.2 Output Design

In designing the output ,there must be given strict attention. The quality and acceptability of any system is determined by the quality or appearance of its output. The output of a computerized system varies depending on the input design and processing algorithm. The output is usually a function of the input data and the processing logic. What is needed at a given moment determines outputs that could be generated. Displaying specifications and procedures as data presentation are keys in output design. User never left with the confusion as to what is happening without appropriate error and acknowledges message being received. Even an unknown person can operate the system without knowing anything about the system.

Figure: 4: Search Form

Table 1: Database

Criminal Identity Number	Surname	other name	Type of Offence	State of Offence	Level of Offence	Criminal State	Local Government	Date	Officer in Charge
Crm / 18	vvd	Crm / 18	44	vvd	Armed Robbery	Lagos	High	Gombe	4r4
Crm / 86	vvvr	vevf	Armed Robbery	Borno	Low	bayelsa	rfr	Monday, Janu...	fvvrcccc
Crm / 24	crefe	refre	Armed Robbery	Bauchi	High	Gombe	rr	Thursday, Jan...	frf

3.1.3 Database Design

In a database concept database are related data which are organize together in a group of object, table, file. It can be in form of node. In this project a relational database concept will be used in this appraise, related data will be store in different table or related data will be organized and store in table.

3.1.4 Process Design

The process design defines the algorithm of the software in a concise and logical order. The process design is represented diagrammatically in the form of system flow chart as shown below:
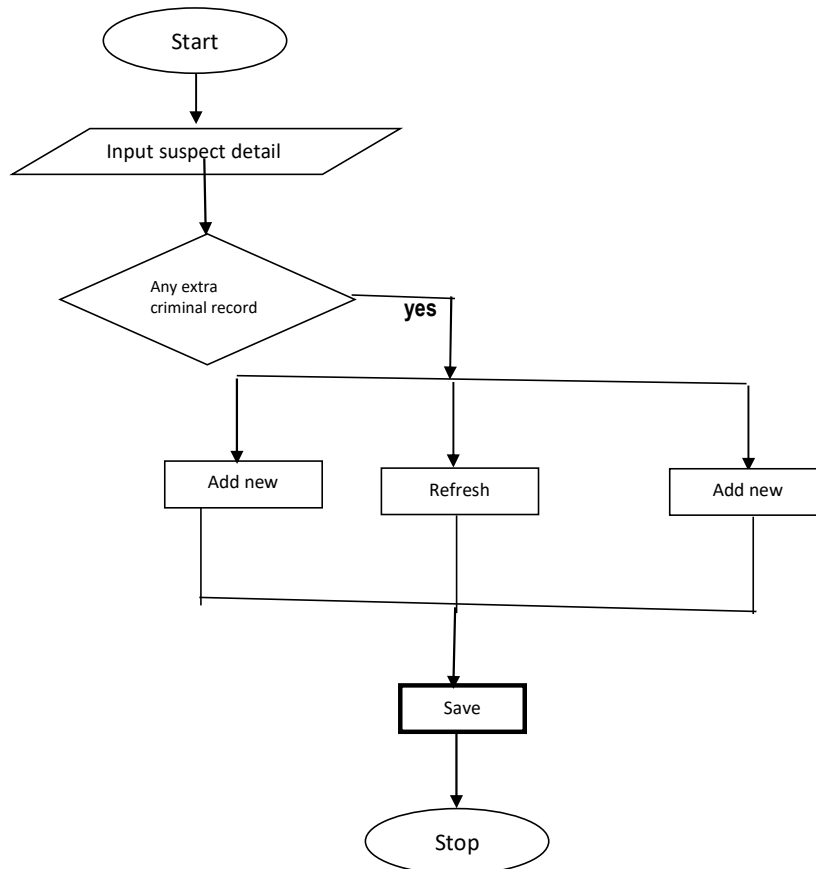
```
                    ┌─────────┐
                    │  Start  │
                    └────┬────┘
                         │
                         ▼
              ╱────────────────────╲
              │ Input suspect detail │
              ╲────────────────────╱
                         │
                         ▼
                   ◇ Any extra ◇ ──── yes
                   ◇ criminal record ◇
                         │
        ┌────────────────┼────────────────┐
        ▼                ▼                ▼
   ┌─────────┐      ┌─────────┐      ┌─────────┐
   │ Add new │      │ Refresh │      │ Add new │
   └────┬────┘      └────┬────┘      └────┬────┘
        │                │                │
        └────────────────┼────────────────┘
                         ▼
                    ┌─────────┐
                    │  Save   │
                    └────┬────┘
                         │
                         ▼
                    ┌─────────┐
                    │  Stop   │
                    └─────────┘
```
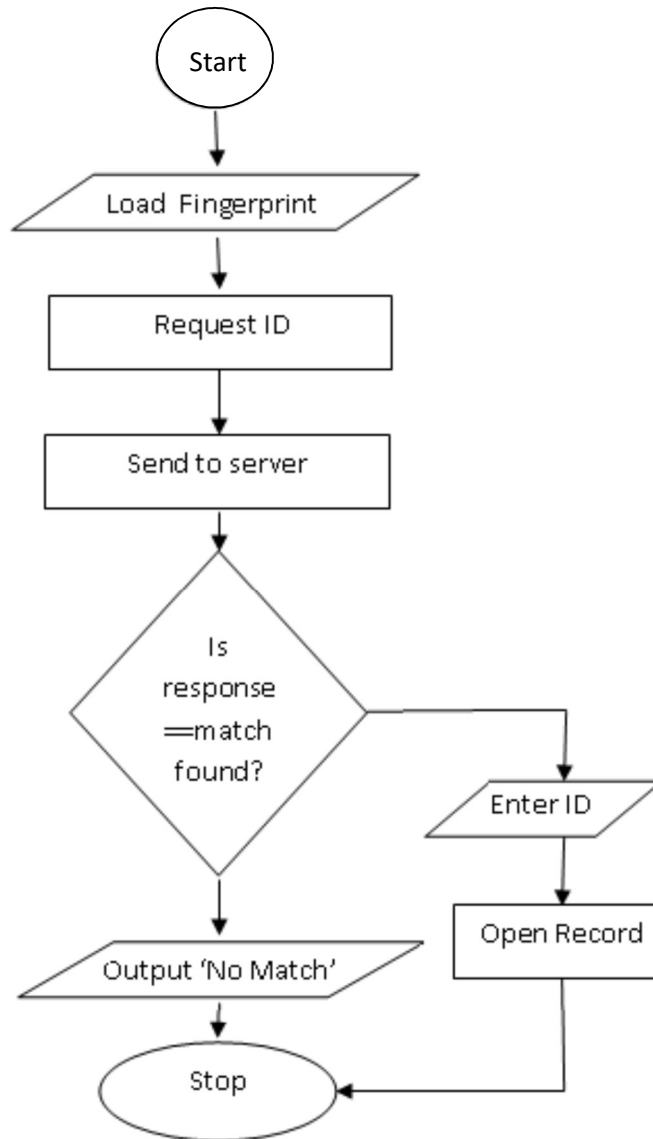
Figure 5: Basic Suspect Entry.

Figure 6 : Finger Print Authentication
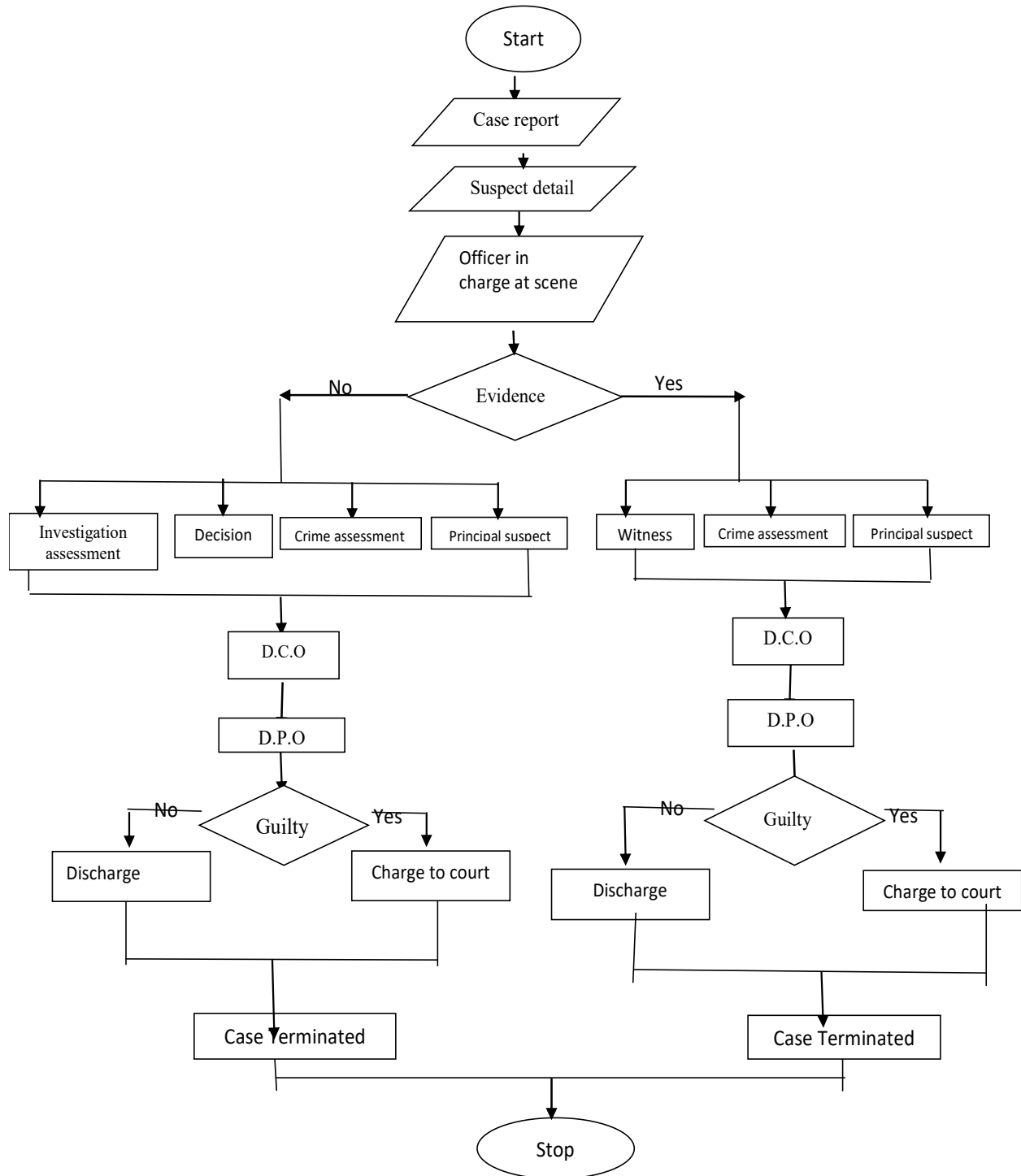
Figure 7: General Flowchart of the System

3.1.5 System Output

The system output processes in which the system will be operated is as below:

1. **Biometric Authentication**: The identification of the user finger print and storing of it in the database,in this application the administrator have limited access to the user login credentials.This authentication helps to create a restriction to certain parts of the application in order to ensure security of the database and the integrity of the user access. In this case administrator will have no right to make change to the user login access because the biometric saves the user biometric as image file so therefore it cannot be alter by anyone.

2. **Biometric Verification:** This involves verification using biometric authentication in the database in order for the user to access the application as specify by the developer.

3. **Update Form: In order to update the** form on the registration interface one needs to; click on update file, the update form will load up, the upload has two tabs which are update criminal data and delete criminal data. Select the preferred tab input the criminal number and the investigation will automatically load up, make the necessary change and click on the update button to save the change data into the database.

4. **Search Form: This is the form that queries criminal investigation simply by biometric verification. It will display the unique investigation of such individual from the criminal investigation database because the criminal biometric is unique in the database.**

4. RECOMMENDATION

It is recommended that Nigeria Police station should implement this criminal investigation system in the police. This process will not only eradicate the manual system but will also improve the security level in the criminal record investigation. Provision of inverter that will be used when power supply is not available ,and use of projector in order to provide clearer investigation are the basic facilities needed to use this criminal investigation system.

5. CONCLUSION

This system is designed for Nigeria police force in order to help manage criminal investigation using biometric. This particular project deals with the problems that occur in Nigeria police station where criminal is swap for one another which occur when carried out manually. Identification of the drawbacks of the existing system leads to the designing of computerized system that will be compatible to the existing system with the system which is more user friendly and more GUI oriented. It is pertinent to say that the system designed can be used in various police station with little or no modification to add value to their services. In order to soothe and satisfy the demands of the station; improvements and modifications could still be made on this system.

REFERENCES

1. Alemika, E. (2004). Crime and Policing in Nigeria. Retrieved 10 February 2017 from www.akamaiuniversity.us/PJST14_2_242.pdf
2. Crime About Systems (2017).Crime About System Retrieved 10 February 2017 from http://www.crimeaboutsystem.com
3. Hiew, B.Y., A.B.J. Teoh, and Y.H. Pang (2007). "Digital Camera based Fingerprint Recognition". Retrieved from 15 February 2017 from ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=4448572
4. James N, (2010). Forensic Voice Comparison and Forensic Acoustics. Retrieved 13 February 2017 from cancun2010.forensic-voice-comparison.net
5. Nelson and S.G. Sharma. (2011).Touch-less Fingerprint Recognition System at Airports. Retrieved 5 February 2017 from www.akamaiuniversity.us/PJST14_2_242.pdf
6. Sohnen, E. (2012). *Paying for Crime*: A Review of the Relationships between Insecurity and Development in Central Africa. Retrieved 15 February 2017 from www.migrationpolicy.org/pubs/RMSG-PayingforCrime.pdf