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Design of Operational Software for Investigation and Intelligence Department of Nigeria Police Force

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Abstract: A software application for automating the operations of the Investigation and Intelligence department of Nigeria Police Force was designed. The software application was developed using Microsoft visual studio 2008 Express Edition, incorporated with MYSQL relational database technology and biometrics capabilities. The software application design was made up of three parts; the first is the Vb. NET interface that gives the desired graphical input and output, Secondly, the database that stores and retrieves data and lastly the hardware device (Secugen finger print reader) which matches the criminal or suspect identity using fingerprint minutiae. Performance evaluation and testing of the designed software application was done and the result shows its suitability for the operations of the Investigation and Intelligence department of the Nigeria Police force and its adaptability for use by any National Police Force.

Key words: Database, biometrics, fingerprint, minutiae, criminal, suspect

INTRODUCTION

The Police play important roles without which the sustenance of order, legality, development and democracy may be difficult (Reiner, 2000). The primary role of Police is policing-securing compliance with existing laws and conformity with precepts of social order. Nigeria has a National Police Force governed by a colonial legislation Police Act cap 359 of the laws of the Federation of Nigeria, 1990 and the 1999 Constitution. In 1990 and 1999 constitution, section 4 of the Police Act provides that the Police shall be employed for the prevention of crime, the apprehension of offenders, the preservation of law and order, the protection of life and property and due enforcement of all laws and regulations with which they are charged.

Members of the Nigeria Police Force have statutory powers to investigate crimes to apprehend offenders to interrogate and prosecute suspects to grant bail to suspects pending completion of investigation or prior to court arraignment to serve summons and to regulate or disperse processions and assemblies. They are also empowered to search and seize properties suspected to be stolen or associated with crime and to take record for purposes of identification, the measurements, photographs and fingerprint impressions of all persons in their custody. The Nigeria Police Force has carried out these statutory roles over the years with the following limitations:

- Preparation of suspects records, criminal records, missing person's records, missing properties record and wanted person's records have been done manually
- There are inherent delays in processing and filling of criminal cases in court due to the manual preparation of case files
- There is no central suspect and criminal record database making quick search mechanism for criminal records, suspect records, missing person's records and missing properties records impossible
- There are inadequacies in the security of records within police commands

In this study, these limitations were explored to design operational software for the Investigation and Intelligence department of Nigeria Police Force. Nigeria Police Force has command, administrative and organizational structure for her operations. The administrative department in charge of investigation and intelligence is the D-department.

The functions of the D-department include criminal investigations, criminal intelligence, criminal records, forensic matters, Narcotics, antiguitics and Interpol (Policeinsignia.com). The operational software for the D-department will be developed through a design process. Design is the process of deciding how the software will

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meet the requirements of the tasks to be performed by the software. The tasks to be performed by the software application to be designed are:

- Provide a user-friendly graphical user interface on computer system to allow scheduled Police officers to input suspect's biodata, biometric data, crime committed, date of crime, arrests details, user privileges, Police organizational structure in charge and provide corresponding output on the display system
- Provide a divisional, area, local, state and zonal database which are all copied to the central database for all the records created by the schedule police officers at these levels
- Generate reports from the information stored in the database

The proposed approach to the design of this software is divided into three parts: graphical user interface design, database design and biometric interface design. Object-oriented design methodologies will be used due to its advantages. Object-oriented design involves design based on modeling classes and objects in the application domain generally follows a hierarchical data abstraction strategy where the design components are based on classes, objects, modules and processes, its operations are related to specific objects and classes of objects and its groups of classes and objects are often combined into frameworks. The advantages of Object-oriented design are it is easier to understand components in isolation since data coupling and visibility have been reduced, it is more adaptive to specification and implementation changes since changes are localized, class data and member functions are equally emphasized and it promotes reusability of objects (Schmidt, 2003a, b). Relational database model will be used for the database design. The relational model is a logical representation of the data that allows the relationship between the data to be considered without concerning oneself with the physical implementation of the data structures. A relational database is composed of tables. Each table consists of field arranged in rows and columns. Different users of a database are interested in different data items and different relationships between the data items. Some users want only certain subjects of the table columns. Other users wish to combine smaller tables into larger ones to produce more complex tables (Converse *et al*., 2004). Biometric interface design involves creating a software platform for taking biometric information. Biometrics is an automated method of recognizing a person based on physical or behavioral characteristics. Biometric information that can be used to accurately identify people includes fingerprint, voice, face, iris and handwriting and hand geometry. There are two key functions offered by a biometric system. One method is identification, a one to many matching process in which a biometric sample is compared sequentially to a set of stored samples to determine the closest match. The other is verification, a one to one matching process in which the biometric system checks previously enrolled data for a specific user to verify whether that individual is who he or she claims to be. The verification method provides the best combination of speed and security especially where multiple users are concerned and requires a user ID or other identifier for direct matching. Using biometric identifiers offers several advantages over traditional and current methods. This is because only biometric authentication is based on the identification of an intrinsic part of a human being (Secugen Biometric Solutions, 2009). The objectives of this design are:

- To ease police officer the stress in the preparation of criminal records, missing person's records, missing properties records and wanted person's records
- To ease police of the stress they go through and time delay in processing and filing of criminal cases since criminal records will be fully automated
- To implement and create a central criminal record database using biometric input machines and equipment (Secugen fingerprint reader and other auxiliary facilities)
- To increase security on a criminal, person, properties records within police commands
- To implement comprehensive quick search mechanism for criminal records, missing person records and missing properties records

MATERIALS AND METHODS

The major software materials used for this software application design are the operating system Microsoft vista, window installer, NET Framework 3.5, Microsoft Visual studio 2008 express edition, MySQL database software released in 2005. The hardware materials used for this Software Application design are laptop computer system with 1GB RAM, 80GB hard disk, digital camera and Secugen fingerprint reader with USB interface Fig. 1.

Design steps: The Visual studio 2008 express edition was used as a major tool for the software development. The Visual studio software and MYSQL software were installed system on the laptop computer. The Secugen finger print reader driver and the digital camera driver were

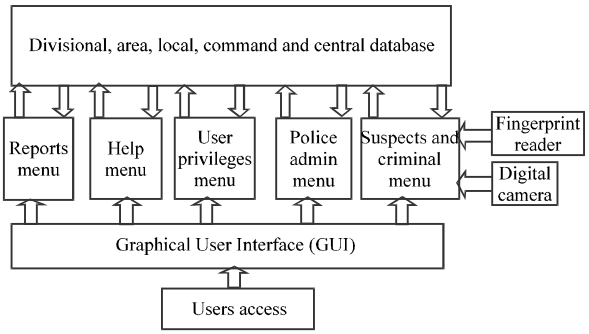

Fig. 1: Proposed block diagram for the software application design

installed on the laptop computer. The Secugen fingerprint reader and the digital camera were connected to the laptop computer through the USB ports. The designed software application was edited, compiled, loaded, code-verified and executed. The following design steps were followed in the design of the software application.

Designing the forms: Forms are an integral part of any Visual Basic.NET application. It has a Graphical User Interface (GUI). Forms are comprised of a visual representation and supporting code. Forms are what the user sees and interacts with. In Visual Basic it is these forms with which we research. They are the base on which we build develop all the user interface and they come with a rich set of classes.

Forms allow us to research visually with controls and other items from the toolbox. Thirty forms were designed with supporting code in visual basic for this software application. The forms are frmAlert, frmApply_sec_to_priv, frmApplyPriv, frmArrest, frmCrimeCategory, frmDivision, frmDocument, frmFaces, frmFingerPrint, frmLocalGovt, frmLogin, frmMissingPer, frmMissingProp, frmPost, frmPrivilege, frmReport, frmRReport, frmsearch, frmSecHamPlus, frmSettings, frmSource, frmStateCommand, frmSuspect, frmSuspectBioData, frmUser, frmWantedPers, frmZones, MDIParent1, SplashScreen1.

Designing the class modules: A class is a variation of a user defined data type that groups together data members and methods that operate on these data members. The data members and methods are saved together in a separate module called a class module. Each class has a name which shows in the properties window of visual studio 2008. The public properties and methods of a class are known as the public interface of the class. The public interface properties and methods are the only ones used outside the class. In this software application design, the following class modules were used which include all the forms in the project.

- Class CPrinter.vb
- Class FrmSecHamplus.vb
- Class FrmAlert.vb
- Class Frmlogin.vb

Class CPrinter.vb: This classmodule was designed to ensure that criminal data is being printed successfully from the database.

Class FrmSecHamplus.vb: This classmodule was designed to take care of all the Secugen methods in the program. Secugen methods include Enrolment, Adjustment, Enumeration, Verification, Capture and host of others to manipulate the database.

Class FrmAlert.vb: This classmodule was designed to ensure that alert or warning gets to the users while working on the application.

Class FrmLogin.vb: This classmodule was designed with a very strong encryption algorithm. It was used in this project for security purposes and accessibility such as managing user's access and privileges to the application.

Designing the modules: Modules are places where you can put your commonly used subroutines, functions, user-defined type, constants and enumerations. The practice is to create reusable functions and subroutines and place them in a module so that they can be used in other projects.

After a module has been added to a Visual Basic.NET project, any other forms, classes or modules within that project can access all public members of the added module. In this software application design, six modules were used. They are module Database, module VImage, module VFinger, module settings, module service and module mdiDataconnection. The modules and their functions are described below:

Module database: This was used to connect the Secugen fingerprint reader to the database and also show the filepath directory.

Module Vimage: This was used to save images to file.

Module Vfinger: This verifinger 4.2 module which was used to communicate with the device called Secugen fingerprint reader. It was used for registration, features, extraction, verify finger, matching, identification and capture.

Module settings: This was used for authentication of the devices in the application.

Module service: This was used for drawing color and dimension of the images.

Module mdidataconnection: This was the backbone of the software application. It contained eight subroutines and two public functions which were used in this application. The subroutines were Public Sub OpenDB, Public Sub CloseDB, Public Sub RecordsManipulator, Public Sub listdisplay, Private Sub display, Public Sub ComboDisplay, Private Sub display2, Public Sub display. The functions were Public Function fetch, Public Function AddFeatures.

Public sub opendb: It was used for opening the database connectivity to connect the database and application together.

Public sub closedb: It was used to close connection between database and the application once the application has been exited.

Publicsubrecordsmanipulator: It was used to query the database. Also to show that the record has been saved successfully.

Publicsub listdisplay: It was used to read from the database.

Public function fetch: It was used to fetch records from the database.

Public function addfeatures: It was used to save the fingerprint.

Designing the database: The database will:

- Record, update and edit data such as the crime category, Zone, state command, Local Government area, divisional, missing person, missing property, wanted person, username among others
- Keep details and records of different criminals
- Hold user's detail such as password, complete name, username, etc.
- Extract different sets of data e.g., a list of all criminals within a period of time
- Prepare and print reports on various things such as criminal reports within a period of time, criminal list at any point in time and so on

The database was created using the MySQL database.

Designing the table for the database: After the database was named, the next step was to create the new table to hold the data by defining the structure of the table. The name of the table was typed in the provided textbox and the number of fields, specified and then clicked go button. In all, twenty-nine tables were created. They are arrests, crime, dba_users, divisions, faces, fingerprint, fingerprints, lga_table, localga, menu, menu_head_tab, menu_tab, missing_pers, photos, policestations, prev, privilege, security, statecommands, statements, state_table, stolen_prop, suspectbiodata, suspectcategories, suspects, users, user_prev, wanted_pers and zonalhq. We used ADO.NET objects in code to create connections and read data using the data reader.

RESULTS AND DISCUSSION

Performance evaluation and testing: We have named this software AutICReS which means automated intelligence and criminal records system (Fig. 2).

Using the AutICReS: After installing the AutICReS on your computer system, the first login screen appears. Type your assigned Username and Password in the appropriate boxes and click on Log In on the displayed screen as shown in Fig. 3, the menus that appear are the privileges assigned for you.

Admin menu: This menu is where all the data input relation to the set of crimes committable, Police Zonal Headquarter, State Headquarter, Local Govt. and Divisions are registered.

Crime category: It is used to register any crime category like murder, armed robbery, man slaughter and stealing in this application. To edit any crime category, select the name of the crime in right pane. Immediately the Crime information will display.

Change every necessary thing you want to change and click on save button. You can also undo any change provided the save button has not been clicked. You can also delete any record from the database. To do this select the item to be deleted from the list of items and hit the Delete button followed by the Save button to make it permanent.

Zonal headquarters: To register any Zonal Headquarter (like Lagos zone, Oyo Zone, Benin zone and among others) of your area:

Fig. 2: AutICReS log in screen

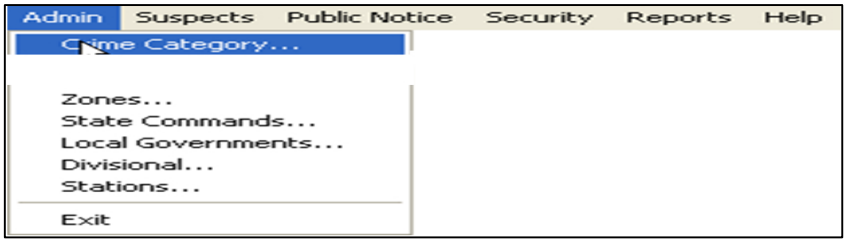

Fig. 3: Menus display screen

- Navigate to Admin menu and select Zones
- This will bring a form. First click on Add New button to clear all entry fields for new record
- Fill all the fields provided
- Then click on Save button to save record

To edit any zonal headquarter; Select the name of the zone in right pane. Immediately the zone information will display. Change every necessary thing you want to change and click on Save button. You can also undo any change provided the save button has not been clicked. You can also delete any record from the database. To do this select the item to be deleted from the list of items and hit the Delete button followed by the Save button to make it permanent.

State commands: To register any State Category in this application:

- Navigate to Admin menu and select submenu State Command
- This will bring a form. First click on Add New button to clear all entry fields for new record
- Fill all the fields provided
- Then click on save button to save record

To edit any State command, select the name of the state in right pane. Immediately the state information will display. Change every necessary thing you want to change and click on save button. You can also undo any change provided the save button has not been clicked.

You can also delete any record from the database. To do this select the item to be deleted from the list of items and hit the Delete button followed by the Save button to make it permanent.

Local govt category: To register any Local Govt. in the State:

- Navigate to Admin menu and select Local Govt
- This will bring a form. First click on Add New button to clear all entry fields for new record
- Fill all the fields provided
- Then click on Save button to save record

To edit any Local Government, Select the name of the local government in right pane. Immediately the local government information will display. Change every necessary thing you want to change and click on Save button.

You can also undo any change provided the save button has not been clicked. You can also delete any record from the database. To do this select the item to be deleted from the list of items and hit the Delete button followed by the Save button to make it permanent.

Division: To Register Division in each Local Government in the application:

- Navigate to Admin menu and select Division
- This will bring a form. First click on Add New button to clear all entry fields for new record

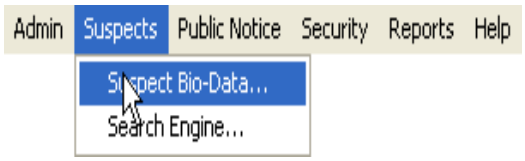

Fig. 4: Suspects menu display screen

- Fill all the fields provided
- Then click on save button to save record

To edit any Division, select the name of the division in your local government in right pane. Immediately the division information will display. Change every necessary thing you want to change and click on Save button. You can also undo any change provided the save button has not been clicked. You can also delete any record from the database. To do this select the item to be deleted from the list of items and hit the Delete button followed by the Save button to make it permanent.

Suspect bio-data

Creating new suspect record: Navigate to suspect Menu and select Suspect Bio Data submenu as shown in Fig. 4.

- On the Bio Data form, first click Add New to prepare the form for new record. Fill all the fields provided with correct data
- Click on the Browse button to upload passport or portrait of the suspect. Make sure the passport is in jpeg and gif
- Click Save to register suspect

The Sex field can only accept either male or female. Any input apart from these will lead to error also the Code Number has been configured to generate integer automatically. To avoid error message which can lead to shut down of the application, please adhere to this instruction.

Capturing suspect fingerprint: After which you have saved the new record you just created:

- Click on the finger print button at the top to capture finger print of the suspect as shown in make sure that all necessary tools e.g., Fingerprint scanner and your digital camera if available are plugged into the computer

Before you can start capturing any fingerprint, you must do some setting. These settings are instructions that the scanning device will follow to function as expected. Below are the settings that you need to do:

- Click list Scanner to select Fingerprint Scanner, then click Open button and check Monitor to return to Capturing Environment
- To start capturing one after the other, click Enroll button as shown in the environment below. Make sure you follow the sequence of the finger you click capture
- And if you will like to capture concurrently, click on the Start Capture button. And after which you have captured the ten fingers, you required to click on the Next and Finish button to stop capturing else the scanner will be expecting more finger to scan

The finger you just scanned are automatically saved in the database. Also note that every fingerprint you scanned is being compared against the existing fingerprint in the database. So if the suspect already had record with you, his information will automatically pop up.

Registering the arrest detail: Click on Arrest button. First click on Add New button to create new arrest detail which contain date, time of arrest and Officer in charge Fill all the fields as you see it, then click on Save button to save the record.

To edit any record, just select the record you want to edit, all the information pertaining to that record will be displayed. Make changes and ensure that you click on Save button. You can also undo any change provided the save button has not been clicked.

You can also delete any record from the database. To do this select the item to be deleted from the list of items and hit the Delete button followed by the Save button to make it permanent. Still in the Arrest Environment, here is where you will do the statement upload:

- Click on Statement Doc button to see the environment where you will upload the statement
- In the environment being displayed, first click Browse button which will now display an Open Dialog box, select the file which you had scanned using your document scanner. Then click Open

To upload any file, make sure you had already scanned the document and saved in a directory which will be very easy for you to retrieve. To edit any Statement, Select the name of the document in right pane. Immediately the document information will display. Change every necessary thing you want to change and click on Save button. You can also undo any change provided the save button has not been clicked. You can also delete any record from the database. To do this select the item to be deleted from the list of items and hit the Delete button followed by the Save button to make it permanent.

Search engine: conducting suspect records search:

- Navigate to Suspect menu an select Search Engine
- Fill the fields provided with either names or alias for this purpose of searching and then click on Find button
- Immediately every record relating that search will bedisplayed in the space provided
- Select any of the record and click on it, immediately the total record of that particular criminal and his/her photograph will be shown

Public notice: The process any record relating to Missing Person, Wanted Person and Stolen Property for Public Notice follow the following instructions.

Missing person: To register any case relating to Missing Person:

- Navigate to Public Notice menu and select Missing Person as shown in Fig. 5
- This will bring a form. First click on Add New button to clear all entry fields for new record
- Fill all the fields provided
- Click on Browse button to upload Photograph or portrait and finally click on Save button to finally save the record

To edit any data, select the name of the missing person in left listbox. Immediately the information will display. Change every necessary thing you want to change and click on Save button. You can also undo any change provided the save button has not been clicked. You can also delete any record from the database. To do this select the item to be deleted from the list of items and hit the Delete button followed by the Save button to make it permanent.

Missing property: To register any case relating to stolen or missing property:

- Navigate to Public Notice menu and select Missing Property
- This will bring a form. First click on Add New button to clear all entry fields for new record
- Fill all the fields provided
- Click on Browse button to upload Photograph or portrait and finally click on Save button to finally save the record

To edit any information, select the name of the information in left listbox. Immediately the information will display. Change every necessary thing you want to change and click on Save button. You can also undo any change provided the save button has not been clicked. You can also delete any record from the database. To do this select the item to be deleted from the list of items and hit the Delete button followed by the Save button to make it permanent.

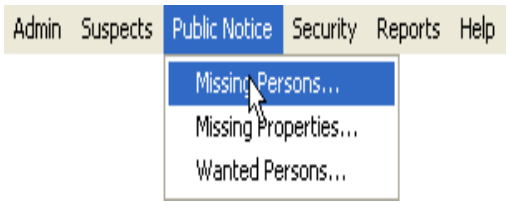

Fig. 5: Public notice menu display screen

Wanted person: To register any case relating to Wanted Person:

- Navigate to Public notice menu and select wanted Person
- This will bring a form. First click on Add New button to clear all entry fields for new record
- Fill all the fields provided
- Click on Browse button to upload Photograph or portrait and finally click on Save button to finally save the record

To edit any information, select the name of the information in left listbox. Immediately the information will display. Change every necessary thing you want to change and click on Save button. You can also undo any change provided the save button has not been clicked. You can also delete any record from the database. To do this select the item to be deleted from the list of items and hit the Delete button followed by the Save button to make it permanent.

Users records administration: Creating new user and deleting user:

- Navigate to the user sub-menu under Security menu as shown in Fig. 6
- First click on Add New. This will clear all the text boxes and assign an expiry date for the user
- Enter the information as required on the form
- Click on Save button to finally save your entry
- To Delete, select Username from the left box, then click on the Delete button and finally save the operation by clicking on the save button
- You can click on the Close button or the Red button at the upper right corner of the form to do carry out the same operation

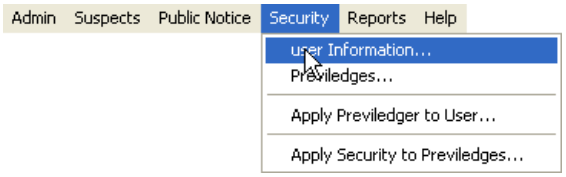

Fig. 6: Security menu display screen

The Username and Password fields are very important fields that the user needs to access AutlCReS.

Assigning privileges to users: For the User to be able to access AutlCReS, the user needs to be given privilege. To do this, follow the steps bellow:

- After User Registration is completed, under Security Menu, Navigate to the Security menu as shown in Fig. 6. Click on Apply Privilege to User
- Select the Username from the list on the left panel then assign privilege by checking on the Privileges and click Save

Assigning menu to privilege: Navigate to the apply Security to privilege sub-menu under Security menu:

- Select the Privilege from the list on the left panel then assign menus by checking on the list of Menus in right most pane and click on Apply button to save Note that the form of privilege has been set under the same Menu

Report:

- Navigate to Report menu and select Report submenu:
- Click on Report submenu to bring a form

CONCLUSION

The performance evaluation of the designed software application (AutlCRes) showed that this software will enhance the operations of the Investigation and Intelligence department of Nigeria Police Force. Proper records of suspects, criminals, missing persons and missing properties can be taken quickly and accessed by authorized scheduled police officers for urgent response and processing.

Case files, details of crime and details of arrests can be prepared and accessed quickly and Policing in Nigeria will be more effective. Finally, this software has editing features for customized use and can be adapted for use by any National Police Force.

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