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## An ICT-Based E-Collaborative Application for Law Enforcement Agencies in Nigeria

**Olaniyan, O. & Mapayi, T.**

Department of Computer Science  
Bells University of Technology  
Ota, Nigeria  
Tayoolaniyan2001@yahoo.com

**Ibikunle, F.A (PhD)**

Electrical and Information Engineering Department  
School of Engineering  
College of Science & Technology  
Covenant University  
Ota, Nigeria

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## ABSTRACT

ICTs are effectively showing new dimensions to old institutional setups. There is a reinforced thrust for an informed and participatory citizenry for efficient e-governance. It goes without saying that impact of ICT on institutional changes is fast spreading across the boundaries of social and political arrangements of societies. This is because ICT is the biggest enabler of change and process reforms with minimum resistance. Decades of attempts for government and process reforms fade in the face of what ICT has achieved in few years. In this paper, the idea to make enterprise applications interoperable via central relational databases to support road safety and crime control system is proposed. The following sections discuss how the notion of online decentralised database can be adopted to structure specific solutions to interoperability problems. Section 5 gives the architecture, design and technique for the web-based database implementation; how the database can be processed and accurate statistics about law enforcement generated and analysed to support planning, decision making and control of operations by the authorities involved in enforcement of law is shown. The concludes with a summary of the salient points.

Keywords: ICT, Government, Collaboration, Law Enforcement Agencies and Interoperability

## 1. INTRODUCTION

The government of any country is the biggest producer of data and information. In fact government's business mainly consisted of data processing and using information within its own departments as well as disseminating it in public for the benefit of the citizens. Thus the job of any government is highly data intensive. Putting in a larger context, the information systems within the government need to be effective and efficient. Information system whether manual or computerized deals with information and its management and due to the advent of information and communication technology, almost all the organizations world over are using the technology for faster processing and dissemination of information.

An information system is considered as organized combination of people, hardware, software, communications networks and data resources, that collect, transform and disseminate information in an organization (O'Brien, 2002). Dissemination of information in timely manner, in right format, in right place and with right possessor is needed to make a good information system. Information is the concept unique with reference to its receiver which means that the same data may convey different meaning to different people unless right format, time, place and authority are not properly agreed upon in advance between the sender and the receiver.

Government is a system with hierarchy of subsystems working in tandem for sharing information amongst to achieve multiple goals. Hence, there is the need for good information systems within government to disseminate right information amongst the departments, to its constituents, to inform citizens with the policy matters in right mode and to provide government services online. This use of computerized information systems amongst the government departments and reaching out to public for government services delivery is called e-government or sometimes e-governance (the use of information system to improve overall governance scenario) (Fagianni et al, 1999; Amar, 2010; Kamar & Ongo'ndo, 2007).

## 2. RATIONALE

The Nigerian government, especially the economic and law enforcement agencies, is in dire need of a database management system that would contain the biodata of every citizen. What is obtainable in such agencies in Nigeria is that branches of an agency do not even have access to the information of another branch talk less of that of another agency entirely. The lack of such centralized database management system has left cracks in the operations of the agencies. It is a moot question and needs to be investigated whether the execution of these applications is going on ad hoc basis or the deployment addresses the specific needs of government agencies paying proper attention to the overall need of interaction among the diverse ICT systems within different government departments in order to share and exchange the data. Policy makers in Nigeria are faced with problem of overlapped and uncoordinated data sources. Some inherent complexities are involved in the government data repositories, for the governments hold large amounts of heterogeneous data from a wide variety of sources with many different schemas (Collins et al, 1998; NRC, 2002).

Hence, careful designing is very important in e-government databases. Consistent and meticulous designed database which caters for the future need of e-governance plans can become a great source of good governance in addition to efficiency and revenue increase to government exchequer (Read & Tilly, 2000; Berndt et al, 2003; Berndt et al, 2004).

### 2.1 Nigeria & E-Governance

Some components of e-government have already commenced in Nigeria e.g. the Nigerian Customs Assycuda Programme, the computerization of Resident Permit by the Nigerian Immigration Service, computerization of Land and Certificate of Occupancy in the Federal Capital Territory Administration (FCTA). The payroll of some organizations are also being computerized (ePayment), online checking of West Africa Examination Council (WAEC), National Examination Council (NECO)

and Joint Admission and Matriculation Board (JAMB) result as well as National Youth Service Corps (NYSC) postings are part of real time and cost effective services which are part of e-government (Mohammed, et al, 2010). In spite of the aforementioned, ICT is still in its infancy in Nigeria due to inadequate equipments, infrastructure, information, illiteracy and power outages etc. It is therefore, essential to incorporate ICT into all areas of government such as agriculture. Chouldrie et al (2010) examined the influences gender and cultures have on e-government awareness.

They attributed the slow diffusion of e-government in Africa to gender inequality and cultural issues. People from different Nigerian tribes- Ibo, Yoruba, Hausa were used for research and it was proven that diffusion is affected by culture and gender in Nigeria. Adeyemo (2010) assessed Nigeria's e-government ranking and found out that it is a far-cry from that of Cape Verde which is another African country that ranks first in West African sub-region. He concluded that Nigeria still need to improve further on its ICT services and communication systems, and that since ICT infrastructure need electricity to operate, the country's epileptic power supply should be improved.

Basically, the barriers to effective integration of ICT in law enforcement operations in a developing economy like Nigeria's are:

1. Lack of integrated information systems for operations
2. Poor quality data and information services for mission-critical processes i.e. inconsistent data storage.
3. Poor ability to exchange information with other related state and national agencies i.e. data sharing. Problem-solving clearly depends on the availability of robust data (Read & Tilly, 2000).
4. A reluctance to share information
5. Low information technology literacy in the country
6. Need to access multiple databases to retrieve related information
7. The uneven distribution of Internet facilities, high cost of connection and in some cases low penetration of high speed connectivity to the Internet.
8. Limited ability to analyse information because of its disparate locations
9. Poor timeliness and quality of data capture: This produces a mandatory flaw of a slow response.
10. Insecurity of information and information system
11. Inefficient Resource Allocation
12. The government is being faced with management challenges in the implementation of E-Government (Kamar & Ongo'ndo, 2007).

### 3. RESEARCH METHODOLOGY

The present study adopts retrospective method of research. Officials at the agencies were interviewed to understand and to get details about data storage. Some related past works and literatures were thoroughly studied and questionnaires were distributed to collect data on information storage and relevant details before developing the system model. Since database design and implementation are the cornerstones of any data intensive application, the databases of e-government applications implemented within last three years by the two agencies were collected.

Though the law enforcement agencies collect vast amounts of data, only a very small part of this information can be absorbed from spreadsheet packages and record management systems used. This is especially true of some Law Enforcement Agencies who will at some time be involved in an interoperability emergency response with other Law Enforcement Agencies from Federal, State, and Local Governments.

### 4. SYSTEM ARCHITECTURE, DESIGN AND IMPLEMENTATION

#### 4.1 System Architecture

The system architecture here is the structure and organization by which modern system components and subsystems interact to form systems. All databases in the proposed system were created to be application specific i.e. the databases are being used for e-government. These databases are maintained and managed using proprietary MS-SQL Server. The MS-SQL Server is based upon Relational Database Management (RDBMS) principles. Both agencies- the FRSC and the Police Force were chosen on the basis of their usability in e-governance scenario. Consistency, data sharing and reliability are major factors while designing databases because of large amounts of heterogeneous data come from a wide variety of sources (NRC, 2002).

At the most basic level robustness and proliferation of e-government services depends on the core designing principles of databases and for this reason adherence to the identified parameters viz. Primary, Foreign key, Data Redundancy, Documentation, Stored procedures, Constraints, Transactions Handling, E-R Design and Master-data management are important and are necessary for building fairly good reliable and consistent database for long term sustainability of solution (Dotolov and Strickler, 2003).

The front-end was developed using VB.NET and Hypertext Pre-processor. The former takes care of the windows based aspect while the latter enables the mobile feature. Government officials can type in search keywords and then click a button to modify or retrieve results. Securing the system is also a very important factor.

For this reason, an authentication technique (username and password) was to prevent unauthorized access to the database system. Since it involves a democratic government like Nigeria, the policies can change frequently in order to meet the citizens' requirements of information. It is imperative in this work to conform to the basic parameters of designing of databases so that scalable, consistent and quality database evolves over the time.

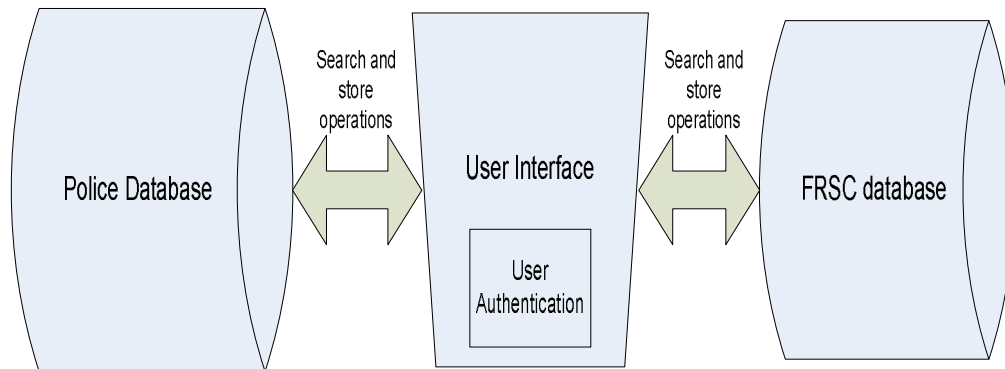


Figure 1. Architecture of the Proposed System

The operations of both agencies are similar in that they are both charged with maintaining law and order in the society. The FRSC deals with license, vehicle registration, accidents and road offences. The Police deal with crimes such as theft of property and accidents. The operations of both agencies intersect at accidents and also meting out punishments in form of penalties to road offenders and criminals.

The architecture of the system follows the indirect interoperability technique which manages and manipulates heterogeneous databases through the use of an intermediate data model and data manipulation language. The research work used the canonical interoperability model which uses an interface to bind heterogeneous databases as depicted in Figure 2 below. Access control implemented was user authentication which ensures that data cannot be manipulated or viewed by just anyone who does not have the permission to do so. It restricts the use of the system and ensures that only authorized individuals can carry out specific transactions on the system. Access control levels guarantee data integrity and security.

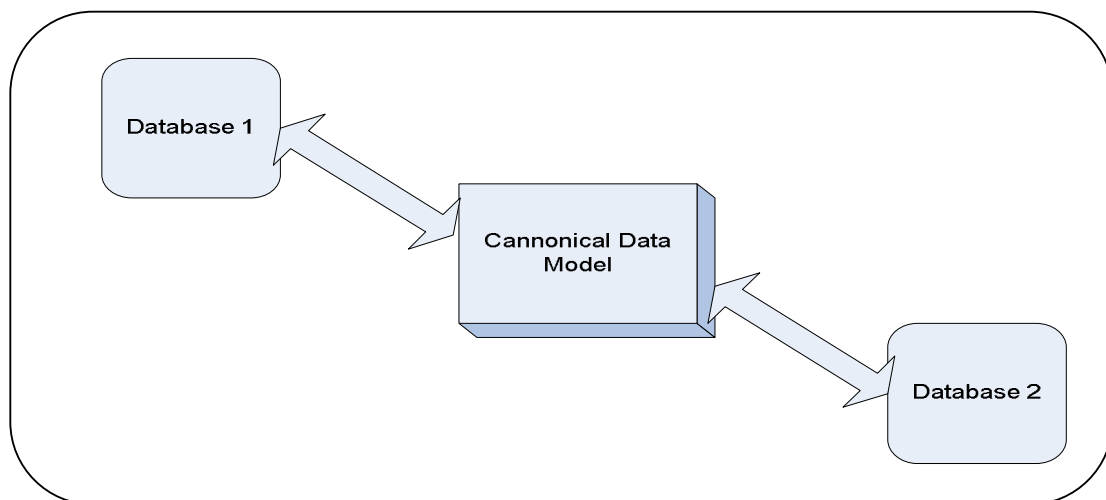
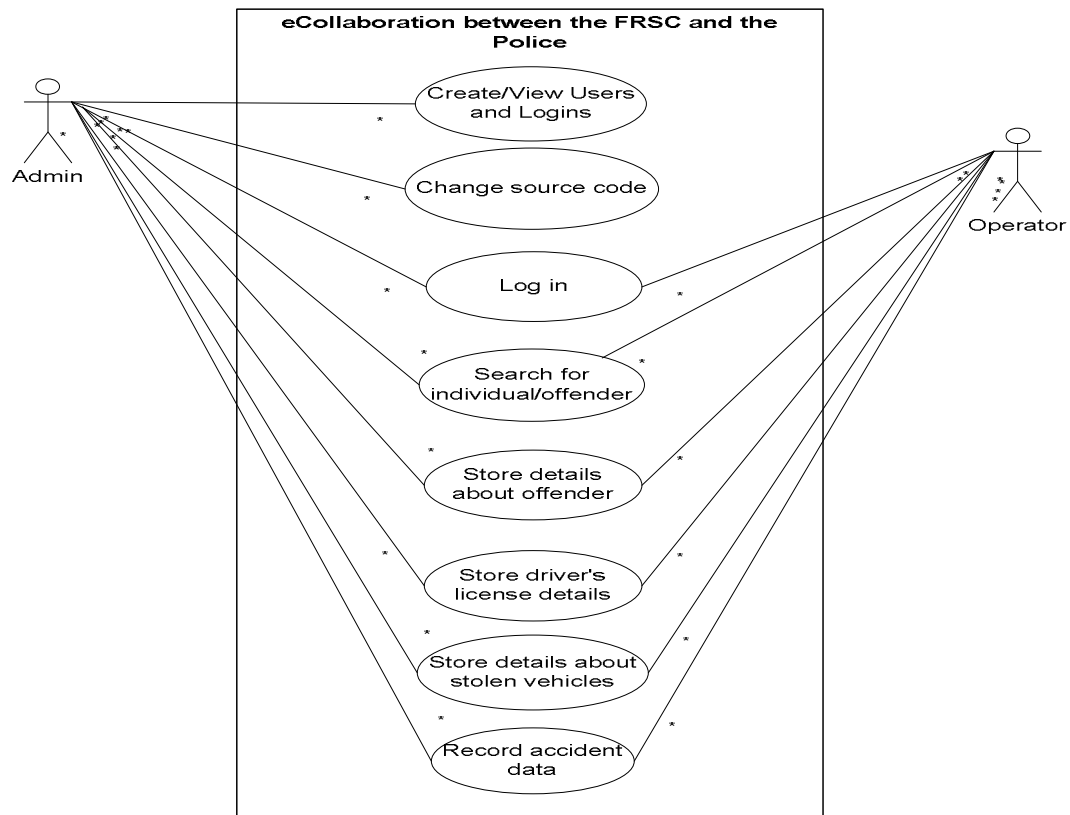


Fig 2. Canonical Interoperability Model

#### 4.2 System Design

A formal model of the proposed system is built using Unified Modelling Language (UML). UML is a family of graphical notations that help in describing and designing software systems, particularly software systems built using the object-oriented (OO) style. UML provides a number of diagram types as a mechanism for entering model elements into the model and showing overlapping sets of models, elements and their relationships.



**Fig. 3. The Use Case Diagram**

The diagrams required for this proposed system are: The Use Case Diagram in Figure 3 describes what a system does from the stand point of an external observer. The emphasis is on what the system does rather than how. The Class diagram in Figure 4 describes the structure of the system by showing the system's classes, their attributes, and the relationships among the classes. It has three parts: the class name, attributes of the class and the relationship or function.

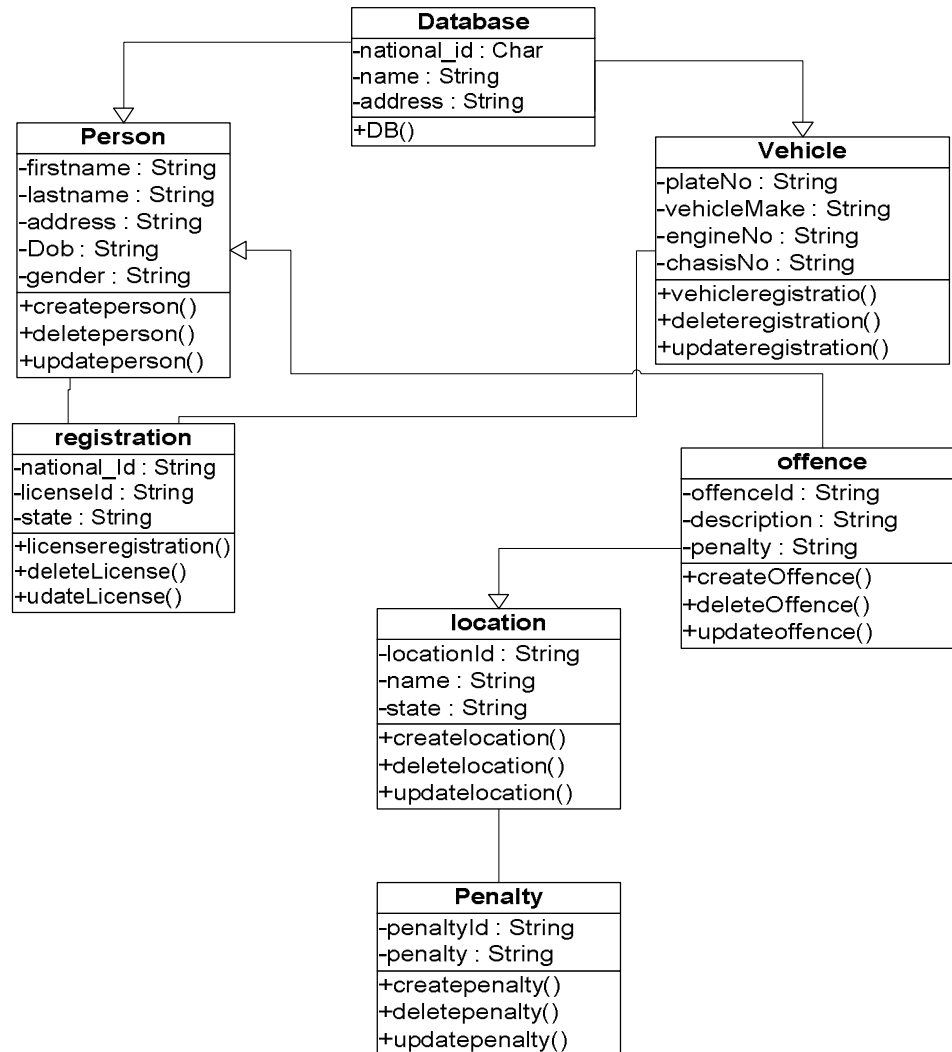


Fig 4. Class Diagram

### 4.3 System Implementation

This subsection describes the functionality of the various interfaces in order to achieve the aim of the system.

#### *The Windows Based Interfaces*

The Personal Data Page as shown in Figure 5 enables the administrator record the details about a particular national identification number. If the number already exists in the database, it auto generates the other fields. The Create button records fresh details. The update button updates already stored data and the delete button removes records from the database e.g. in case of death.

RISC - PERSONAL DATA

File Registration

License No:

National ID:

Last Name:  First Name:

Address:

Date of Birth:

Gender:

Height:  Blood Group:

Marital Status:

Religion:

Phone No:

Completion:

State:

List Refresh Create Update Delete

Figure 5. The Windows Based Person Form

The Driver's License Registration windows based form shown in Figure 6 collects data pertaining to driver's license. After all fields have been filled, clicking the create button saves them in the database. If records about a particular identification number exist, auto fill automatically generates the other fields.

RISC - FRSC License Registration

File Registration

Driver's License ID:

National ID:

Issuance Date:  Friday August

Expiry Date:  Friday March 0

Class:

List Refresh Create Update Delete

Fig 6. The Windows Based Driver's License Registration Page

#### 4.3 Web Based Interfaces

The Login and Home Page: This enables the users to enter their usernames and passwords which determine the level of permission they have. When the Login button is clicked, it opens the home page. This page serves as the home page for both agencies since there's only one interface. It gives information on what the system is designed for and instructions to carry out these functions. The Offence form: This page shown in Figure 7 can be navigated to by clicking the Offence tab on the home page. It is used to store the offences committed by road users. Once the national identification number of the individual is entered and the Book Offence button is clicked, it navigates to the Offence Booking page which automatically shows the details about the offender. The only detail that needs to be entered on this page is the code of the offence. All other information is auto-generated from the national identification number.

Fig 7. The Web Based Offence Booking Page

The Accident page: Clicking the Accident tab leads to this page shown in Figure 8, it is a form used to collect relevant data concerning accidents such as number killed, injured, casualties and so on. Clicking the Submit button stores this information in the database. Navigating to the View Accident list hyperlink reveals a report of all accidents and the necessary details as shown in Fig 9.

Fig 8. The Web Based Accident Form

The Criminal History page is a form that collects crime details about a particular person. All the fields are needed to store the crime an individual has committed in the database. If the national identification number already exists in the database i.e. the individual has previously committed a crime, the personal details section is automatically filled. The Submit button stores all details as shown in Figure 9.



Location	Accident Date	National ID	Plate No	Casualties Injured	Casualties Killed	Accident Grade
ota	Jun 26 2011 8:25AM	a000	1001A	2	0	Minor
yola	Jun 26 2011 8:29AM	a000	2001a	0	0	Minor

Fig 9. The Web Based Accident List

The hyperlink Criminal Record links a page that shows both road and crimes committed by that particular identification number as shown in Figure 10.

Home > **Criminal History**

[Report Crime](#)  
[Criminal Record](#)

**Criminal History**

National ID:  License No:

Location:

**PERSONAL DETAILS**

First Name:  Last Name:

Address:

Date of Birth:  Gender:

Height:  Blood group:

Complexion:  State:

Martial Status:  Religion:

Phone:

**CRIME DETAILS**

Description:

Exhibits Recovered:

Suspects arrested:

Date:

Fig 10. The Web Based Criminal History Page

The Stolen Vehicle page as shown in Figure 11 is a form that stores details about stolen vehicles. The FRSC can view this page but cannot alter it. The Submit button delivers the data entered to the database. The View Stolen Vehicles hyperlink leads to a page that displays all previously stolen vehicles.

Fig. 11: The Web Based Stolen Vehicle Page

## 5. DATA COLLECTION

Data for this paper is on secure site for Law Enforcement Agencies in Nigeria. It is not freely accessible to any users unless the official permission is granted by the Administrator. Therefore, the data is highly confidential for this paper. The Administrator for the agencies consider in this paper could be contacted for further enquires.

## 6. RESULTS AND DISCUSSION

Some of the systems that have attempted to enable cross-jurisdictional communication are: Phoenix Police Department Reports (PPDR) - a web-based, federated intelligence system in which databases shared common schema [10].

Bioterrorism Surveillance Systems- used data warehouses to integrate historical and real-time surveillance data and incrementally incorporated data from diverse disease sources [11, 12].

The National Incident-Based Reporting System (NIBRS) (Federal Bureau of Investigation, 1992), a crime incident classification standard, proposed to enhance data sharing among law enforcement agencies [13].

In the Violent Crime Linkage Analysis System (ViCLAS) [14], data collection and encoding standards were used to capture more than 100 behavioural characteristics of offenders in serial violent crimes to address the problem of entity-level matching.

The proposed system in this paper ensures that: Data such as the high accident and offences figures is stored effectively and efficiently Little or no effort required to use the system (learnable and easy to navigate). Usage of the system is not restricted to a desk; it can be used anywhere due to the mobile feature.

A well designed interface, user-friendly interface, and optimized speed with little or no paperwork is available. A security layer which ensures consistency and reliability and gives the assurance that the system cannot be tampered with by just anybody is realized.

## 7. CONCLUSION

This work proposed a system to facilitate collaborative processes between two Nigerian law enforcement agencies: the Police and the Federal Road Safety Commission. Both agencies can operate the system through one interface following the canonical interoperability model. The eCollaboration system contains two virtual databases- one for the Police and the other for the FRSC. They stores the details regarding their different operations. The interface is used to tie the heterogeneous databases.

The application designed is a Web-based database to be used by officials of the Nigerian Law enforcement Agencies-FRSC and the Police. The transparent and expressive nature of the system would no doubt ensure that perpetrators of lawless acts be discovered with ease by these government agencies thereby ensuring an orderly society with efficient and good governance.

It is also important that the government being the service provider should motivate the employees to deliver services through ICT. To achieve this, the Civil service employees must be trained on technology and start realizing the advantages of ICT. The aim is to make them thorough with e-Governance applications and responsive to the technology driven administration. It is worthy to state here that the introduction of ICT in the system will not take away existing jobs but will make them easier, and if less manpower is required for operations, the staff can be re-deployed elsewhere with no threat to their career growth path.

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## Author's Briefs



Engr. Olaniyan Olatayo Moses (M.SC), a Lecturer at Bells University of Technology, Ota, Nigeria. He teaches computing in the Dept of Computer Science and Information Technology. Engr Olaniyan obtained the B.Tech

Computer Engineering degree from the Ladoke Akintola University of Technology, Ogbomoso and a MSc in Computer Science from the University of Ibadan, Ibadan, Nigeria. Presently on PhD degree focusing on Telemedicine Research his other research interest includes Computer Networks and Human Computer Interaction. He can be reached on [tayoolaniyan2001@yahoo.com](mailto:tayoolaniyan2001@yahoo.com). Phone +2348038457998.



Dr, Ibikunle Frank Ayoleke (JP), received the B.Tech. degree in Electrical/Electronics Engineering from University of Science and Technology, Port-Harcourt, Rivers-state, Nigeria in 1986. In 1993, he won himself a Federal Government Scholarship award to study abroad and obtained a Doctorate degree in Telecommunications and Information Engineering (by research work) in 1997 from the University of Posts and Telecommunications, Beijing, China. He has 26 years practical working experience with the largest telecommunications carrier company in Nigeria (called NITEL) and the mobile arm of the NITEL Ltd. (called M-TEL) before joining the academics. He is presently at Covenant University, Electrical and Information Department of the School of Engineering, College of Science and technology, Ota, Ogun-state. His present areas of research are in Next Generation Converged-IP Network, Artificial Neural Networks for Signal Processing and Broadband Wireless/Wired Access Technologies (OFDM, MIMO, WiMAX, WiFi, 3G/4G, FTTx). He has over 30 technical publications in both national and international journals and conference proceedings. He is a member of the following professional societies: Council for the Regulation of Engineering in Nigeria (COREN), Nigerian Society of Engineers (NSE), MIEEE and Nigerian Institute of Management (NIM). Dr Ayoleke Ibikunle is happily and fruitfully married.



Mr Tope Mapayi is a Lecturer at the Department of Computer Science at the College of Information and communication Technology, Bells University of Technology, Ota, Ogun State, Nigeria. He had his BSc in Computer Science at the university of Ado-Ekiti, his Msc at the University of Ibadan, and currently a Phd research student at the Department of Computer Science and Engineering, Ladoke Akintola University of Technology, Ogbomosho, Oyo State, Nigeria. He is a member of Computer Professionals of Nigeria. His areas of Specialization includes; Biometric, Computer Security, E-governance, Soft Computing and Image Processing. He can be reached by e-mail through [tmapayi@yahoo.com](mailto:tmapayi@yahoo.com). Phone No. +23480339126100