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Full Paper
**A FRAMEWORK FOR INTEGRATED WEB BASED SIM
REGISTRATION SYSTEM (IWSRS)**

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ABSTRACT

The relevance of Information and Communication Technology in our routine activities cannot be over emphasized; hence there is need for daily, weekly or monthly communication among us. The introduction of Global Satellite for Communication (GSM) and the internet is a welcomed development that has eased our schedules which can be done within a predefined period. In addition the issue of security has to be taken into considerations while using some of these technological innovations. As a result of usage of mobile for communications and to ensure security of lives and properties, there is a need for a secured database of mobile phone subscribers in order to help the government most especially in securing a nation as most recently the issue of insurgencies, militancy, kidnapping and other vices that are causing disharmony, anarchy in our society today. In view of all these challenges, this paper proposes an implementable framework for unifying or integrating the nations Subscriber Identification Module (SIM) registration activities in view of solving the issue of multiple registrations by mobile phone subscribers, in-adequate database and constant collections of subscriber's details while registering another SIM. More so benefits of the proposal herein are enormous to stakeholders in the Nigerian Telecommunication Industry which include reduction in time, cost and resources expended during and after SIM registration.

Keywords: Subscriber, SIM Registration, Centralized Database, Mobile Network Operators, Telecommunication Industry, Nigeria

11. INTRODUCTION

According to Ali (2012) Information Systems (IS) has become a crucial point for organizations to survive in technology-focused environment. The amount of resources needed for information system infrastructures in organizations are large, hence there is need to engage or use a robust, well secured systems that will give out the best services required to handle organizational demands. Collaborating the extent of technology, Abdullahi and Hassan (2011) asserted that technology advances, particularly in the area of information and communication keep growing on daily basis, taking advantage and keeping abreast of these technologies is a paramount concern to organizations.

The advent of mobile communication systems has revolutionized the way information are sent or communicated (Adeyegbe n.d.) (Mallikharjuna, Naidu & Seetharam n.d.). The development has brought about ideas, innovation in the field of telecommunication. This is evident from revelation in the work of Diana (2008) stating around two third of the world's populations are connected with mobile phone as of 2008, while statistic from The International Telecommunication Union shows an estimated value of 6.8 billion mobile subscriptions worldwide as of February 2013, which directly represents 96 percent of the world population (ITU 2013).

Nigeria is not left out from the rapid development the world has recorded in the area of mobile communication as the country strives to become a technology driven economy (ITU 2013). In 2011, the US-Embassy in Nigeria at its economic section presentation on Nigeria's telecommunication fact sheet placed telecoms sector as the most viable and fastest growing industry of the Nigerian economy, creating direct and indirect jobs. However, Mbendi (2014) maintained the telecommunication services which began in Nigeria in 1986 via a connection between London and Lagos remain under developed before the sector was deregulated fully in 2001. The deregulation exercise brought about lesser restriction in the sector leading to inauguration of a full GSM services in Nigeria (Mbendi 2014). Despite the aforementioned changes, there still remain some big

challenges, such as service quality and hideous crimes committed using mobile phones (Agba 2001). Many believes the government is to be blamed because after the inauguration of the GSM services in 2001, Subscriber Identification Module (SIM) cards were offered to mobile subscribers without the proper requirement for registration, to aid identification of the subscribers.

In 2002, there was an attempt by the regulatory body, Nigeria Communication Commission (NCC) to enforce subscriber registration. The effort did not yield much result because emphases was not on the documentation of telephone lines that are in use against the name and full identity of those who purchase them for use. Consequently, security implications surfaced as a result of the negligence. According to NCC (2016a) more recently the quest for subscriber registration has risen. NCC and several other partners rolled out compulsory registration of mobile lines for existing and new subscribers to check some of these hideous crimes in the society and also to improve service delivery. Therefore the necessity to review the existing SIM registration system and provide unique general platform that is cost effective for subscriber authentication begins.

Finally, registration of identity information to activate a mobile SIM card, are fast becoming universal in Africa, with little to no public debate about the wider social or political effects. Also, SIM registration represents a form of communications surveillance that reduces the anonymity once afforded, perhaps unintentionally by prepaid airtime. These identification mandates may bring modest security benefits, although as noted, the evidence for such claims remains inconclusive (Kelvin & Aaron 2014).

2. LITERATURE REVIEW

Subscriber Registration is a documentation of the mobile lines that are actively in use against the names and full identity of those who have purchased them for utilization (Omo-ettu 2012). It implies getting good details of all the things that happen in the network such as the identity of all subscribers to network amenities. Such information is needed to manage today, and to strategize for the future. To utilize the



aspect of it that can help combating cases of kidnapping, terrorism, social harassment and to also serve as a larger whole part of planning the national life, education, health, transport, and so on.

The SIM card has been one of the important technologies deployed or utilized by Mobile technology, whereby each phone uses a unique identifier to use the available networks. The SIM card is designed in various formats such as full-size SIMs, mini SIMs, micro-SIMs, embedded-SIMs and nano-SIMs but not limited to the mentioned as technology continues to expand. According to Elaheh (2013) the SIM is security element used in the authentication of the subscriber before granting him/her access to the mobile network. The ingenuity of the SIM lies on the fact that it is a separate tamper resistant module which can be installed or removed from the mobile phone. However, with the advances in wireless and storage technologies there is proposal to replace the current SIM by the so-called soft SIM, which consists of a tamper resistant module soldered on the mobile phone and a software SIM downloadable over-the-internet.

To use this SIM card, a subscriber need to register this SIM card as a documentation to ascertain the ownership of the SIM and to be able to use it on the available network which varies from different mobile network operators. According to Etisalat-Nigeria (n.d.) during registration a subscriber is required to make available for use full names, residential address, age, date of birth, state of origin, occupation, photograph, nationality, religion, Subscriber SIM MSISDN, SIM serial and biometrics information like thumb print. Outbound calls and SMS services will not be accessible by the subscriber until the SIM is fully registered. However, subscriber can receive calls and SMS that are inbound on an unregistered number for 30 days period starting from the when the first call from the SIM card was made. Deactivation of SIM card occurs after 30 days if the SIM remains unregistered at the end (Etisalat-Nigeria n.d.) (Bingham 1999).

According to *The mandatory registration of prepaid SIM card users* (2013) in many countries around the world, consumers can buy prepaid or 'Pay As You Go' mobile SIM cards from retail outlets usually with little or no paperwork involved. Unlike pay-monthly mobile

SIM contracts, the activation and use of prepaid SIM cards does not always require the subscriber to register or present any identity documents at the point of sale. The researcher further stated that, in countries where prepaid SIM registration is not required, mobile subscribers can access mobile services more easily, but can also voluntarily register with their mobile network operator (MNO) in order to use additional services that require identification, such as mobile banking.

Mean while in Nigeria, there are issues of security of the present SIM card registration process whereby Mobile Network Operators allow their agents register mobile subscribers using several customized SIM registration applications, databases. A similar case to Bangladesh where cases of SIM cards registered with false information by dealers are widely used for committing crimes (Nazmul, Mohammed, Raisul and Nazia, 2014). To lessen the rate of crime committed by using mobile phones in Bangladesh, Nazmul et. al, (2014) proposed a cloud based system model which shows an online method of SIM card purchasing and registration. Their proposed method resolve the conventional system of mobile purchasing and registration in Bangladesh and most importantly the issue of security in order to reduce the rate crime are committed using mobile phones and also encourage mobile user to register their SIM cards without any stress.

2.1 CURRENT STATUS OF SIM SUBSCRIBERS IN NIGERIA

The Federal Government through the Nigeria Communication Commission (NCC), the regulatory agency mandated the compulsory registration of subscribers SIM as a tool to combat insurgency, terrorism and most importantly security issue, sadly adequate and up-to-date subscribers details are yet to be perfected either due to sale of unregistered SIM card, double registration, provision of change/update of certain sensitive information of the subscribers. According to NCC (2016a) the objectives of the NCC when it mandated nationwide registration of SIM users in March 2011 were to:



- Assist security agencies in resolving crime and by extension to enhance the security of the state;
- Facilitate the collation of data by the Commission about phone usage in Nigeria;
- Enable operators to have a predictable profile about the users on their networks; and
- Enable the Commission to effectively implement other value added services like Number Portability among others.

Due to the importance attached to it and through supervision, by July 2013, Bio-key International (2013) asserted the NCC had reportedly uploaded more than 110 million entries to its database facility, including users' biometric details (thumbprints) and issues approximately 8 million new SIMs annually through its multiple mobile network operators. To further enumerate the extent of SIM subscribers in the country, NCC (2016b) reported that more than 188 million mobile phone subscribers are connected to one mobile network service to another. However, only 139,143,610 million of these lines were active by the end of 2014 as shown on table 1.

Table 1: Subscriber statistics

	OPERATOR	2014
Connected Lines	Mobile (GSM)	184,782,512
	Mobile (CDMA)	3,743,811
	Fixed Wired/Wireless	365,871
	Total	188,892,194
Active Lines	Mobile (GSM)	136,772,475
	Mobile (CDMA)	2,187,845
	Fixed Wired/Wireless	183,290
	Total	139,143,610

According to NCC (2016c) at the end of third quarter 2015, NCC had reported an increased figure for the active lines to 150,660,631 million with the mobile network operators taking 98.52% of the total number of active lines as shown on table 2.

Table 2: Operators data

Latest Data: Quarter 3 - 2015	
OPERATOR	Sept 2015
MTN Nigeria Communications	62,493,732
Globacom Limited	31,306,472
Airtel Nigeria	31,134,625
EMTS Limited (Etisalat)	23,492,214
Sub-Total (GSM)	148,427,043
Visafone Limited	2,031,802
Multilinks Telkom	10,213
Sub-Total (CDMA)	2,105,981
Visafone Limited	63,396
Multilinks Telkom	2,923
VGC/MTN	9,731
21st Century Technologies	100,986
IPNX	2,879
Globacom Limited	11,658
Sub-Total (Fixed/Fixed Wireless)	191,573
TOTAL	150,660,631
% of Mobile (GSM)	98.52
% of Mobile (CDMA)	1.36
% of Fixed/Fixed Wireless	0.13

Statistics presented in table 1 and 2 shows the Nigerian telecommunication sector has significantly grown since the three companies (M-TEL, MTN and ECONET) were awarded licenses to operate the GSM in January 2001, though operations started in August of the same year, mobile network operators attained about 500,000 subscribers in 2001 (Olayiwola 2010). According to Olayiwola (2010) the industry grew to over 7million subscribers in 2004; in December 2008 the subscribers in the market grew to 62.99million. An addition of 22.59 million subscribers in 2008 alone represented 56% annual growth rate. Recent figure as at January 2009 put the subscribers' base at 64.16million.

From 2009 to date, Nigeria had gradually become the most competitive markets in Africa telecommunication industry with four active GSM mobile network operators (i.e. MTN, GLOBACOM, AIRTEL and ETISALAT) and two active CDMA companies namely VISAFONE and MULTILINKS. The development has resulted in much lower tariffs, a wide variety of innovative services, attractive offers and improvements in service quality in order to differentiate and set the brands aside.

Having said much on the growth of SIM subscription in Nigeria, the researchers are worried if the mobile network operators will keep to NCC's directive of continual SIM registration of subscribers considering the enormous challenges the current systems are faced with. However, if the directive is continued with the current SIM subscription statistics, it could be the largest and most comprehensive biometric database ever assembled on one platform in the Africa, through the SIM registration exercise.

3.0 METHODOLOGY

The researchers identified three (3) key activities for achieving the research aim of proposing an integrated framework for the SIM registration in the country in figure 1.

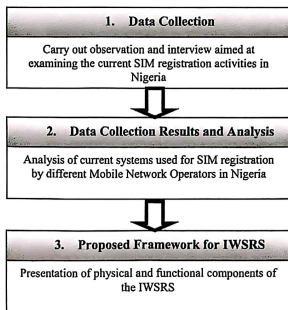


Figure 1: Research methodology activities

3.1 Data Collection

The data collection was carried out in Minna, the capital city of Niger State. Accessible data collection methods were used to examine the current state of SIM registration activities in Nigeria.

A. Observation Method

Due to the relevance attached to the collection of accurate data from the right and reliable source, the researchers set out on observing registration procedures at different location of the city i.e. MTN and Etisalat customer shops located at Tunga, Globacom customer shop located along city gate. Airtel shop located at stadium road. Various registration agents were also visited at Obasanjo complex along Mobil and Uche communication limited at Bosso. This method was utilized for the following rationalities:

- To have first hand information about the mobile network operators and their agents carrying out the registration at various points without embellishment
- To avail the researchers the chance of observing the whole system, its structures and requirements

B. Interview Method

It involves questioning and evaluation. The personal consultations seem to be the most compelling tool in the methods used for data collection. The method gave the researchers insight to certain operational activities that cannot be accessed by absolute observation.

A face-to-face Interaction occurred between the research team and the following questions were asked to attain the level of acceptability, efficiency, and privacy from quotas interviewed;

- Staffs of mobile network operators and their agents
 1. Why do you ask for subscribers SIM registration?
 2. What is your opinion on the level of perception the subscribers have on the issue of SIM registration?
 3. Do you believe having a unified or integrated subscriber registration system online could be more cost effective to your business than the current customized standalone subscriber registration systems you use?

- Registered subscribers
 1. How many SIM do you have?
 2. How long does it take you to register your SIM?
 3. Can you register your SIM from different mobile network operators all at one point?
- Unregistered subscribers
 1. Why is your SIM not registered?
 2. Are you actively connected (e.g. can you make and receive calls)?
 3. Do you plan to register your SIM in the future?

3.2 Data Collection Results and Analysis

The two method of data collection used by the researchers gave a better understanding of the problems inherent in the various SIM registration systems used by mobile network operators and their agents presently in the country.

3.2.1 Observation

The findings gathered during the observation process shows the way SIM registration is done using the current systems as depicted in figure 2.

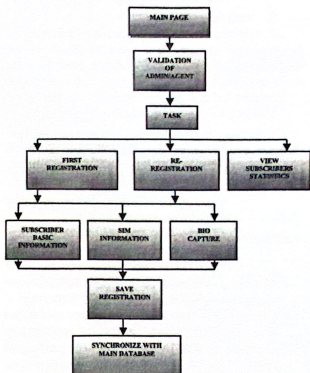


Figure 2: Top down model of the current SIM registration system

Figure 2 depicts the processes involved in the current SIM registration systems; the configuration of the current system varies from one mobile network operators system to another. With the specification given by the regulator (e.g NCC), each mobile network operator has individual Java/Visual Basic programmed software installed on customized mini-laptops distributed to their agents (registered and non-registered) to register subscribers. The system avail the operators' opportunity to register exiting and new customers to its database and likewise forward to NCC and other relevant agency if the need arise.

Functionalities peculiar to these current systems are a single interface which houses the subscriber basic information fields, SIM information fields, bio-data capture fields (photo finger biometric identification). Each subscriber fills a pre-registration form to quicken the process, after a successful process the system pops up message for subscriber registration synchronization with the mobile network operator's main database. The subscriber SIM gets activated within 4hours to 24hours of a successful registration.

The shortcoming of these systems includes; time wastages, duplication of data from different locations, financial waste due to multiple registration outlet on individual platform, fraudulent act due to unregistered agent. The demerits enumerated below can be overcome with the proposal made in this paper.

Multiple registration: The inability of the current system to verify the status of subscriber SIM registration at any registration point, subscribers with unknown SIM status tenders to re-register the same SIM which directly leads to multiple registration entry at the mobile network operators end.

Agent loop holes: The current system is operated by agents, most not registered. Since the authentication of most agents handling the current systems cannot be verified, loop holes are therefore created. These loop holes can lead to criminal and fraudulent activities like hoax calls, terrorism and kidnapping.



Cost implications: The absence of a unified or integrated registration system adversely results into individual platform for all mobile network operators to avail the subscriber chance of registration to enable SIM activation, it directly lead to high cost of buying individual platform to reach millions of subscribers.

Delayed registration: The current system uses an end-to-end retransmission strategy to make sure that data arrives correctly at the mobile network operator's end, which directly leads to delay activation and multiple registration by subscribers.

3.2.2 Interview

The results from the research interview are presented in a Simple Percentage Method (SPM) for easy analysis and interpretation.

In the first interview, a total number of twenty four (24) staffs and agents of mobile network operators were interview (i.e. for each mobile network operator three(3) staffs and three(3) agent was considered at different locations). Results presented in table 3.

Table 3: Interview results for staffs of mobile network operators and their agents

S/N	Questions asked	Response (in number and %) in relation to opinion
1	Why do you ask for subscribers SIM registration?	20(83%) maintained SIM registration is a policy from the Nigerian Communication Commission that should be obeyed while 4(17%) had no idea to why it is done
2	What is your opinion on the level of perception the subscribers have on the issue of SIM registration?	16(67%) revealed that subscribers do not see any importance of SIM registration, thus so many false information are provided during registration while 8(33%) believes they do.
3	Do you believe having a unified or integrated subscriber registration system online could be more cost effective to your business than the current customized standalone subscriber registration systems you use?	21(88%) believes the prospect of the IWSRS while 3(12%) did not see the importance of proposing the IWSRS thus doubts its effectiveness against the existing standalone SIM registration systems.

In the second interview, a total number of twenty four (24) registered subscribers for all the mobile network operators were interview (i.e. for each mobile network operator six (6) registered subscribers were considered at different locations). Results presented in table 4.



Table 4: Interview results for registered subscribers

S/N	Questions asked	Response (in number and %) in relation to opinion
1	How many SIM do you have?	19(97%) uses at least two (2) SIM from different mobile network operators while 5(21%) uses a single SIM from a single mobile network provider
2	How long does it take you to register your SIM?	22(92%) believes the time taken to register a SIM is not reasonable and should be less than 20minutes while 2(8%) believes the time taken is ok.
3	Can you register your SIM from different mobile network operators all at one point?	This question was directed to the 19 registered subscribers that revealed they make use of at least two(2) different SIMs from different mobile network operators. 19(100%) revealed no, that they had to go to each mobile network operator to have their SIMs registered while 0(0%) none had no contrary view

mobile network operators were interview (i.e. for each mobile network operator six (6) unregistered subscribers were considered at different locations). Results presented in table 5.

Table 5: Interview results for unregistered

S/N	Questions asked	Response (in number and %) in relation to opinion
1	Why is your SIM not registered?	8(33%) did not see the importance of doing so while 16(64%) could not imagine going through the stress
2	Are you actively connected (e.g. can you make and receive calls)?	4(17%) are actively connected even as unregistered subscribers while 20(83%) are not actively connected on any network because they have failed to register their SIM.
3	Do you plan to register your SIM in the future?	17(71%) intend to register soon when they have the time while 7(29%) revealed that they will only be interested to register their SIMs when the stress involved is minimized

subscribers

In the third interview, a total number of twenty four (24) unregistered subscribers for all the

3.3 Proposed Framework for IWSRS

This section of the methodology presents an implementable framework for achieving the proposed IWSRS.

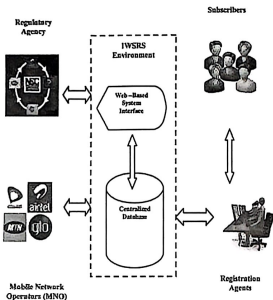


Figure 3: Physical components of the IWSRS

Figure 3 shows the interaction established between the different physical components and stakeholders of the IWSRS. A subscriber communicates their personal data for SIM registration to a registration agent. The registration agent interacts with the IWSRS to record the subscriber data. The mobile network operators and the regulatory agency interact with the IWSRS to perform functions peculiar to them as described on figure 4.

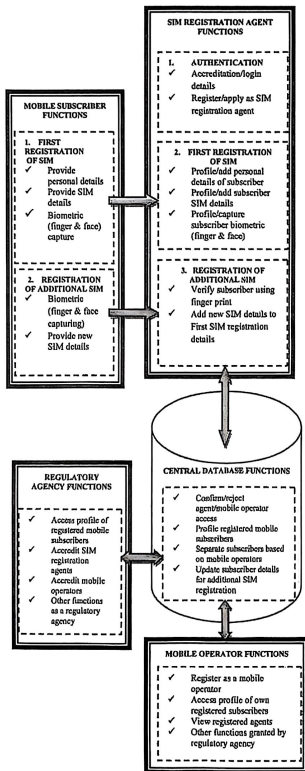


Figure 4: Functional framework of the IWSRS



Figure 4 represents a functional framework of the IWSRS. The framework consists of various functionalities to achieve the research aim. These functionalities are spread across the different physical components shown in figure 3.

A. Subscribers

A new subscriber has to register all his basic details through an approved and accredited agent by providing personal details such as fingerprint/face capturing, name, phone number, date of birth, place of origin, SIM details and other relevant information. This information are then stored through the web application into the database for future retrieval.

B. SIM Registration Agent

An agent can only perform the registration of SIM subscribers if given the license or authority to do so by the Government regulatory agency. Such agent will be given a login details so as to have access to the web application in order to register the subscribers.

Meanwhile, to register a new SIM, the agent has to enter the subscriber's details provided by the subscriber. To register an additional SIM by an already registered subscriber, there is no need of providing the personal details since such subscriber has registered a SIM earlier, what the agent need to ask or to be provided by the subscriber is the already registered SIM number and the fingerprint. On providing such details, the information about such subscriber is display on the screen for viewing in order to confirm authenticity of the subscriber and earlier registration. The Agent only have to now enter the new SIM number and the already saved details of such subscriber is updated in the database without re-registering subscriber's details again.

C. Central Database

A web application designed in a simple user friendly manner is linked to a central database (data repository). The central database has several functions as described in figure 4. The central database provides the unification of subscribers SIM registration as proposed by the research in such a way that every subscriber SIM registration is verified to see if there is an existing registration details of such subscriber in the database.

D. Mobile Network Operator (MNO)

The mobile network operators are companies licensed to provide GSM services by the Government. They perform certain functionalities as proposed by the researchers which include, registration as an MNO, accessing profile of own registered subscribers and other functions that may be granted by the regulatory agency.

E. Regulatory agency

The main function of a regulatory agency (such as NCC) is to regulate, coordinate and monitor the usage of SIM registered and other functions assigned to it by the law, hence in this case their functions is to give web application access to licensed MNOs, registered agents by providing them login details. It also perform the duties of managing the central database in order to ensure confidentiality, data integrity, access control, data management and concurrency handling.

4.0 CONCLUSION

SIM registration for mobile subscribers will be no more a rigorous and time waste issue as the paper proposes an implementable framework for a unified or integrated subscriber registration system where subscribers register their SIM with any accredited agents no matter the network they are using. All what is required is for the subscriber to register through the agents, who must have been accredited or licensed to do so. The web application central database developed will profile and separate details of subscribers of each mobile network operator. In addition the issue of registering another new SIM has been simplified, what is needed is the biometric fingerprint of the previous registration which the system will use to display the details of the subscriber so as to ascertain the authenticity of earlier registration. Afterwards, the new SIM to be registered will be entered at a column provided which will be updated automatically and linked with the previous details and biometric done earlier. In addition, each mobile network operator will be able to access their subscriber's details from the central database when needed through the Government regulatory agency. With this platform, administrative challenges that have bedeviled issue of SIM registration in Nigeria would have been resolved to a certain level.



Finally, though the researchers proposed a web based implementation of the IWSRS for effective usage of functionalities, it is appropriate to point out that web based systems are vulnerable to malicious attacks. The proposed IWSRS is not an exception due to the fact that some subscriber data have market value. So, data encryption at the highest level should be worked upon by interested researchers.

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