International Journal of
Technology and
Systems
(IJTS)

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Journal of Technology and Systems
ISSN : 2788-6344 (Online)
Vol.5, IssueNo.1, pp 22 –39, 2023
www.carijournals.org

Biometrics Application: A Critical Review

T. F. Sholanke

Department of Computer Science and Engineering

Obafemi Awolowo University, Ile-Ife

https://orcid.org/0000-0003-3904-9015

Accepted: 10th July 2023 Received in Revised Form: 30th July 2023 Published: 12th Aug 2023

Abstract

Purpose: This study was carried out to review the rate of biometrics adoption in various arms within Nigeria. Some of the sectional offices of governmental and private organizations were visited during this work.

Methodology: The methods used involves interview of personnel's in the parastatals, review of literature works and observations.

Findings: The findings show that there has been technological advancement in Nigeria with biometrics introduction in some sectors. The work contributed to existing literature on biometrics by conducting a review to determine the rate at which biometric technology have been adopted in Nigeria.

Unique contributions to theory, policy and practice: This will help government in making positive decisions leading to the growth and technological advancement of the country.

Keywords: *Biometrics, Sectors, Technology, Identity Management, Review*

1. INTRODUCTION

Biometric application in this 24th century and global era tends to play a vital role in human recognition. It is a technique of recognizing humans based on their natural endowed features. The world today represents a single entity due to the globalization and digitalization that cuts through several facets of life, unlike the token and password usage era. Nigeria's population is fast growing daily. According to Vitalis and Orunoye (2021), Nigeria's population size is expected to grow to 239 million by 2025 and 440 million by 2050 due to its momentum. There is no doubt that Nigeria needs to employ an advanced technological tool like biometrics as identification this time with its population growth rate. Marcela *et al.* (2021) recorded that biometric technological advancement is expected to advance with a value of USD 94 billion by 2025 at a compound annual growth rate of 36%. Undoubtedly, the future of biometrics is unpredictable with respect to its current technological advancement. This is one of the reasons why biometric means of recognition should be encouraged in Nigeria. One other reason why biometrics is very crucial to adopt in Nigeria today is that it tends to proffer optimal solutions to the current worrisome, heartbreaking and alarming rate of security challenges such as kidnapping and demand for ransom, herdsmen attacks, insurgency, internet fraud, personification etc. The subsequent part of the paper is organized as follows. Section 2 discusses the motivation and drive to this work. Section 3 reviewed related works and examined various sectors that have employed the use of biometrics in Nigeria. Section 4 relates the results of our findings and gave recommendations. Finally, Section 5 concludes the review work.

2. MOTIVATION

Onakoya et al. (2018) opined that Nigeria is critically facing security challenges because its citizens are not uniquely recognized and has led to insecurity in Nigeria with different trends and dimensions from one geopolitical zone to the other e.g., various faceless activities such as religious sects like the Boko Haram in the North, rampant armed robbery incidents in the South-West, notorious robbery and kidnappings in the South-East and South-South. Recently, there was shortage of naira notes due to the deadline issued by the Central Bank of Nigeria for depositing old naira notes to enable circulation of the new with the aim of embracing cashless economy. An emerging question is, *did the government consider the rural area inhabitants before issuing the deadline for old naira note submission*? The urban habitants find it difficult meeting up with the deadline not to talk of the rural habitants as people get to banks to deposit old naira notes due to the deadline but could not access the new naira notes. Other questions are; *how ready is the country for the cashless economy? What percentage of people have access to online banking? The ones that have access to online banking, do they use it for their day-to-day transactions*? The governments should have considered these questions to determine the level of technical know-how of individuals in the country and devoted a quantum range of time, probably a year, to create technological awareness that would have enforced many individuals to internet banking.

Technological advancement in this digital age and its use should not be limited to some certain set or percentage of some individuals but to the nation at large. In the past, customers who don't know how to sign use thumb-mark for authentication. However, today customers' authentication is via a biometric verification number in Banks. The research questions are *how effective will biometric introduction be to Nigerians, and to what extent has Nigerians benefit from the use of biometrics so far?* Recall that Eniayejuni and Agoyi (2011) said that though biometric system is not a new technology but it is new in this part of the world as it is yet to be adopted in Nigeria.

3. LITERATURE REVIEW

A lot of work has been carried out using both unimodal and multimodal biometrics. Unimodal biometrics uses one single trait for recognition while multimodal biometrics combines two or more biometric features for recognition. Biometric recognition systems are used in many areas such as: passport verification, airports, buildings, mobile phones, and identity cards (Ammour *et al.,* 2018). To know the extent at which biometrics is used in Nigeria, some organizations and parastatals were visited and interviewed during this study and challenges were equally noted. To a large extent it was recorded during this study that biometrics had been adopted in some organizations, ministries or agencies saddled with key responsibilities in serving the populace within the country as discussed.

3.1 Identity Management

National Identification Management Commission (NIMC) is the body charged with capturing of citizens' information. They are saddled with responsibilities such as updating of existing identity database and assigning unique serial keys comprising eleven (11) digits serving as citizen's identification number (i.e., NIN). The virtual NIN (vNIN) which is a tokenized form of NIN eleven (11) digit number, can also be generated; these alphanumeric characters of 16 length digit is used for verifying agents who need confirmation for a service at a point in time usually within 72 hours after which it expires. Only the mobile number used in registering NIN can be used to log into the NIMC MWS mobile app to generate vNIN. A multimodal biometric means of recognition is used to generate NIN for individual records which entails capturing process of ten fingerprints, head-to-neck face and signature and demographic data.

Table 1: Information of Countries that have Implemented eCard (Bilal *et al.*, 2010)

S/N	Country	ID	Attributes	Uses
1.	Austrailia	E-ID (2004)	Photograph, Name, Id code, date and place of birth, sex, card number and validity	eGovernment and eServices

2.	Belgium	E-ID(2003)	Photograph, place of birth, date of birth, sex, address, issuing authority, digital signature	e-Service, -portal, online, declaration, home banking
3.	Estonia	E-ID Card (2002)	Name, national id code, date and place of birth, sex, card number and validity	Tax services, health insurance, social security services
4.	Finland	E-ID	Photograph, name, id code, date and place of birth, sex, card number, and validity	Tax services, health insurance, social security services
5.	France	E-ID (2006)	Personal data	e-Government and e-services
6.	Slovenia	E-ID (2002)	Name, place and date of birth, sex, validity	e-Government and e-services
7.	Spain	E-ID(2004)	Photograph, place of birth, date of birth, sex, address, biometric data, handwritten	e-Government, e-banking, e-services
8.	Hong Kong	ID (2003)	Embedded microchip, photograph, name, birth date, fingerprints	Travel document, immigration9.
9.	Malaysia	Mykad	Photograph, fingerprint, name, date and place of birth, card number	IDcard, driving license, travel document, e-cash, touch and go
10.	Pakistan	NIC	Photograph, name, date and place of birth, address, biometric data, card number	Government procedures, commercial transactions
11.	Singapore	NRIC	Photograph, name, race, date of birth, sex, country of birth, card number, issue date and fingerprint	Government procedures, commercial transactions

Mba *et al. (2018) recorded that* as of June 2016, only about 9.5million Nigerians had been captured into the National Identity Database (NIDB), and above 1million National "e-ID" card was produced, and 300,000 National e-ID cards collected. According to NIMC (2022), over eightynine (89) million Nigerians have been captured and enrolled into the national database. The work of Oyeniran *et al* (2019) designed and implemented a model for Nigerian National Central Database to enhance the initialization and performance of National Identity Card for individuals. This study establishes that the proposed Nigerian National Central Database will eradicate loss of documents at different government organizations. It will ensure privacy, curb fraud and impersonation and, reduce processing time. NIMC uses multimodal biometrics used in managing Nigerians database. It should be noted that despite the length of time for NIN registration, Nigerians have not been fully captured implying that Nigerians needs to come to terms in identifying the role this technological tool stands to play in the growth of the country. Prathilothamai and Priyanka (2017) worked on the unique identification scheme of India called Aadhaar, handled by the Unique Identification Authority of India (UIDAI). Every person above the age of 5 years must register their demographic details (Name, Date of Birth, Address and Phone number) and biometric details (10 fingerprints and both iris) and then these details are used for authentication. Mridula *et al.* (2009) reviewed the biometric application in India by providing a general view of scenario of biometrics in India. Biometrics were recorded to have provided technological solutions to various private and public sectors in India areas such as national population register, income tax, government Schools, rural sectors, pensioners, e-Passport, manufacturing companies, banks, cities etc. Also, Bilal *et al* (2010) analyzed different identity cards for various purposes and proposes biometric based identity management system in the Kingdom of Saudi Arabia. The work further shows countries that have implemented eCard for various activities as depicted in Table 1. The table gave summaries technology solutions in various communities. It could be seen that areas such as government and services are the sectors recorded to have witness the impact of technology more.

3.2 Education

Quite several higher institutions of learning are noted to have adopted biometrics as means of student authentication and access control to some facilities aiding to efficient teaching and quality research output. Marcela *et al* (2021) noted that biometrics allows academic institutions to save time and money, improve educational and non-educational activities and offer convenience, safety, and security. Joint Admissions and Matriculation Board (JAMB) is the body in charge of tertiary institutions' entrance examination. The board coordinates entry examinations for candidates seeking admission into colleges of Education, Polytechnics and Universities of private and public parastatals within Nigeria. Any candidate seeking admission through JAMB must have sat and passed (or registered to write) either National Examination Council (NECO), West African Senior School Certificate Examination (WASSCE), or National Business and Technical Examinations Board (NABTEB) examination as these examinations serve as pre-requisite for JAMB. WASSCE,

NECO and NABTEB are senior secondary examination bodies conducting certificate examinations and standard tests in Nigeria. All these boards equally use biometrics as means of authenticating their candidates. Buoye and Ojuawo (2023) stated that only 30 percent of the 1.7 million prospective candidates gained admission in the year 2017 implying that close to 1.7million candidates registered for the examination in the year. JAMB board came up with the biometric approach in a bid to track various forms of examination malpractice and various impersonations considering the millions of candidates writing the examination yearly. The JAMB administrator authenticates candidates using fingerprint registered with the examination body during registration (Amadi *et al*, 2020). Candidates registering for JAMB are mandated to have enrolled for NIMC as a pre-requirement. The candidate's 10 fingers are captured as biometric recognition. In the work of Evwiekpaefea and Eyinla (2021), it shows that the recognition technology and level of security provided by fingerprint feature is no doubt significant progress for JAMB as it aids in curbing stealing (unlike the era when candidates hire someone to sit for the examination on their behalf), forgetfulness of authentication feature, etc.

However, there have been records of candidates who registered but could not write the examination at the stipulated center and time due to the failure of the fingerprint machine to identify such candidates. Such occurrence had caused much to both the candidates and guardians of the affected candidates. This implies that more work is needed in this area to address some of these shortfalls. Marcela *et al.* (2021) reviewed biometric application in education. Biometrics was recorded to be used to aid both academic and nonacademic activities in universities. The work highlighted the applications of biometric in education as follows: identity management, class attendance, e-Evaluation, security, monitoring students' motivation and academic progress. Several cyberattacks in higher education and challenges to biometric implementation in higher education of learning were given. CovidTech was investigated with its potentials on higher education of learning recorded namely: buses in China integrated facial recognition system combined bus thermometers, Russia redesigned its facial recognition technology and Apps were developed in Poland and India to allow selfies upload by citizens.

3.3 Bank

The financial sector is one of the key sectors that have greatly benefitted from the invention of biometrics as transactions were made faster with facilities such as internet banking and automated teller machine

(ATM) thereby reducing the number of customers' presence within the bank hall. Another key advantage an automated teller machine proffers is that account owner can send their trustee to withdraw on their behalf in cases of emergency where such account owner is not physically fit to be present at the bank, e.g., if an account owner is hospitalized and needed cash. Bank Verification Number project was introduced due to increasing incidents of compromise on conventional security systems (password and pin) and a high demand for greater security for access to sensitive

or personal information in the Banking system (Odusina and Fowosire , 2019). A customer provides his or her multimodal biometric feature comprising of facial, 10 fingerprints and signature; which are fused to produce an eleven (11) digit number unique to each account holder. Only one BVN exists for every account owner however the number of accounts or the number of banks such account resides. This imply that BVN serves as a unique (primary) key of each customer serving as the customer ID. Each bank account and biometric details is being secured by DERMALOG´s innovative biometrics. The biometric enrolment process helps the bank to know its customers. In Nigeria, biometric technology has been employed in banks to a considerable extent. Even some ATM uses fingerprints scan to authenticate cash disburse. Job *et al.* (2015) recorded that 46.3 per cent of the total adult population of Nigerians are excluded from financial services implying that there are still individuals who don't bank and tend not to benefit from the advantages that the technology proffer. Robert *et al*. (2020) noted that despite the role of biometric as a reliable technology for identity management in many industries, the rate of its adoption in banking industry is still low which was also established in the findings of this work. Jemimah (2019) carried out a study to examine the level of criminal activities happenings at automated teller machines (ATMs). The work proposed a fingerprint biometric access at the ATMs to replace password and problems encountered with difficulty of forgotten password. However, this study established that some ATM terminals in Nigeria uses biometrics fingerprint facility for financial access.

3.4 Payroll

The integrated payroll and personnel information system (IPPIS) was conceptualized in October 2006 and the project went live in April 2007 with seven (7) pilot ministries, departments and agencies (MDAs) under the office of the accountant general of the Federation responsible for payment of salaries and wages directly to government employee's bank account with appropriate deductions and remittances of 3rd party payments. Ibanichuka (2019) opined that with the high recurrent expenditure, which is eating deep into the national solidarity, there is a need to streamline the ministries, departments and agencies (MDAs) expenses which evolved the existence of IPPIS. The Federal Government partnered with World Bank to introduce biometrics to the salary payment and payroll generation by the IPPIS to solve various irregularities such as corruption, ghost workers, and failed accountability as well as for maintenance of electronic personnel and pay records of government employees to ensure that the records are kept in one location and are continuously updated to reflect the status of personnel (Chima *et al.*, 2020).

IPPIS biometric registration involves capturing of ten finger impressions and face of civil servants. Also, photocopies of; academic qualifications, letter of first appointment, letter of last promotion, six months' bank statement, letter of change of name (if applicable), staff ID, first letter of pension insurance (printout) was collected at the point of registration. The emergence of COVID-19 also encouraged the Lagos State government of Nigeria to commence biometric verification of

pensioners in 2020 to reduce physical contacts. Sakiemi (2019) outlined that the silent and recent tools used by government to minimize corruption are biometric verification number (BVN), integrated payroll personnel information system (IPPIS), and national identity management (NIM) number. BVN system has helped to find and eliminate the 23,306 non-existing public servants leading to monthly savings of 10.5 million euros which is making a sustainable contribution to the positive development of the Nigerian state (Dermalog 2020). The findings of this review work help to ascertain the statement of Earnest and Pearl (2018) that the introduction of BVN serves an advantage in both saving government some expenses and equally protecting customers' interest thereby building a level of confidence in the stakeholders.

3.5 Telecommunication

National Communication Commission (NCC) is an independent national regulatory body representing the telecommunication industry in Nigeria. It was created under Decree number 75 by the Federal Military Government of Nigeria on 24th November, 1992 charged with the responsibility on controlling and managing telecommunication services within Nigeria. The introduction of the global system of mobile communication (GSM) in Nigeria in 2001 helped to overcome some issues associated with dial-up phone configuration. Subscribers are said to have reached 189.3 million as recorded at the end of the 1st quarter (Q1) of 2020 (Ugochukwu *et al.* 2021). M2SYS worked closely with the five major telecommunications companies (MTN, Globacom, Airtel, Etisalat, Visafone) and NCC to create a centralized database for users through their individual subscriber identification module (SIM**)** using fingerprint and facial biometric capture. NCC requires mobile phone users to register their biometric features for SIM authentication. As an example, MTN Nigeria, commenced offering existing customers bonus airtime as an incentive to register their biometrics. This process guarded against illegal sale of SIM cards thereby reducing mobile phone crimes. The major reason for the biometric backed sim registration in Nigeria is for law enforcement agencies to improve their security measures by optimally reducing robberies, kidnappings, cybercrime and terrorism.

This review reaffirms that Nigerians are aware that biometrics authentication is required to have a functional sim for communication and this can be backed up in that some mobile communication devices (phones) users are using biometrics enabled phones. In the work of Diptadeep and Poulami (2016), a proposal for new security system based on biometrics and GSM communication was suggested integrating biometric features to build a multi-layered security system to address security.

3.6 Population Count

National Population Commission (NPC) is the body charged with demographics and citizen count in Nigeria. Nigeria comprises thirty-six (36) different states with a Federal Capital Territory, further divided into six geopolitical zones i.e., North Central, North East, North West, South West, South South, and South East. The local governments are altogether seven hundred and seventy-

four (774) in number. The diversity is: culturally, ethnically and linguistic. The year 2006 witnessed the use of Geographical Positioning System (GPS) and Satellite Imagery to carve out geo-referenced enumeration during census. OMR/ICR/OCR machine readable form were used to collect information and Automated Fingerprint Identification System (AFIS) to read fingerprints to keep track of multiple enumerations. Adeline (2015) noted that there were cases of irregularities in the 2006 population census due to inflation of figures, so also Bamgbose (2009) stated that deflation of figures led to a counter exercise by the states leading to setting up of a committee which produced a different result compared to the original result released by the NPC. A biometric system for data collection is keen to have an accurate and trustworthy data of Nigerians (Eniayejuni and Agoyi, 2011).

A multimodal biometric approach to census count will go a long way in addressing the problem of double headcount or enumeration. Relief materials were said to be distributed across states and local government during COVID 19 pandemic with no answer on *how or the percentage of distribution across region* and these could be due to the inability to determine the actual number of populations per region. Eniayejuni and Agoyi (2011) in their paper analyzed the importance of statistical knowledge of Nigeria's population and proposed a Biometric technology approach for carrying out population census and national identification scheme with an elliptic curve encryption technique to secure the proposed biometric system. Iwuoha (2018) said biometric technology is currently sweeping across developing countries. It is, however, only poorly adopted among rural voter. India's Aadhaar qualifies as a frontier case, with over 1.2 billion biometric enrollees (Ursula and Vijayanka, 2019). This review proposes that the next census in Nigeria be carried out using multimodal biometrics recognition for a credible database as seen in India.

3.7 Health

The national body charged with health insurance for citizens in Nigeria is called national health insurance scheme (NHIS). This body was established under Act 35 of 1999 by the Federal Government of Nigeria to improve the health of all Nigerians at an affordable cost (Dike and Fiberesima, 2012). Ghana and India were also identified as making small but progressive steps towards full population coverage of the national health insurance scheme (Fidelia, 2018). Hospitals need to adopt biometrics for generating Patient-ID which help enhance easier patients' data recovery and trace of medical history report. Some Hospitals in Nigeria uses Electrocardiogram (ECG) and some other equipment that employs biometric features in monitoring and diagnosing patient's ailments. However, the use still needs to expand to accommodate patient record keeping across government hospitals. During this study, a hospital was visited where identity cards of NHIS patients were requested for patient's recognition. The patient identity card was collected for the long admission in the hospital. Mordini *et al.,* (2012) stated that the next generation of biometrics do not provide answers only on whom one is but also expresses how an individual feel, embracing the use of biometrics in hospital not only ends in record keeping but can help in the

diagnosing and administering relevant treatment to patients just as in expert system where we have robots serving as doctors. Even some technological device exist today that can diagnose and detect car faults. Duplicate patient records have dogged the health system in Nigeria while patient information is scattered across multiple departments with no sequential automated identification number (Emeka, 2017).

This work helps to know that biometrics is yet to be fully embraced by Nigerians in health managements and appointments. Most government hospitals use manual method of record keeping and retrieval. Omid and Morteza (2015) worked on a secure biometrics-based authentication with key agreement scheme in Telemedicine networks for e-health services. The work proposed an improved scheme of four phase user authentication scheme for telecare medicine information system (TMIS). TMIS helps in timely delivery service to patients as well as check of vital signs of patient remotely even though the work tends to be expensive. The work provided an improved scheme over Yan *et al* (2013) work highlighting four phases namely, Registration phase, Login phase, Authentication and Key Agreement Phase and, Password and Biometric Update Phase.

3.8 Election

Independent National Electoral Commission (INEC) is the sole body charged with the conduct of election in Nigeria. It has today repositioned itself to deliver credible elections that would sustain Nigeria's nascent democracy. Its presence has been established in all 36 states, the Federal Capital Territory and the 774 Local Government Areas of Nigeria (INEC, 2022). Prior June 2021, registration for PVC was time and effort consuming unlike the era when citizens access internet facilities to register online at ease. A country that have no census figure will find it difficult to carry out a successful election. Biometric technology is often assumed to provide the required solutions (Peter *et al.,* 2017). Today, one can enroll on INEC portal from the comfort of one's home then book for appointment for Biometric capturing and authentication. A list of eight hundred and eleven centers was created as INEC biometric capturing within the country. Once the biometrics is captured, a temporary voter's card is issued prior to the production of a permanent voter's card, which usually take a few months for it to be available. The 2023 election was conducted using a bimodal voter accreditation system (BVAS), comprising finger and face features. INEC has employed several innovative approaches to improve the management and conduct of elections in the country as indicated in our review. In the work of Donovan and Suresh (2012) they proposed a Mobile voting technique for election in Jamaica using fingerprint supported biometric control information and encryption along with Secure Socket Layer i.e. SSL using VeriSign and mobile equipment for a smart phone using Android 3.0. The electoral process in Jamaica is seen as the same process in Nigeria, in the sense that to validate enrolment citizens must visit the registration center of the country. The findings of our research revealed that some voters were not able to perform their civic right due to device rejection at the capturing center of some pooling units.

3.9 Tourism and Reservation

Hotels is also a sector where biometrics had greatly impacted as its use in hotels cannot be under emphasized as virtually most of the leading hotels with ratings of 3 stars and above uses biometrics for various activities such as guest access control, security and automation of other activities for memorable time of stay. The Nigerian Tourism Development Corporation (NTDC), in collaboration with a private security firm, launched a biometric database for hotels to track criminal activities in the country's hospitality industry which is tailored towards ensuring maximum security in the hospitality industry. The emergence of biometric recognition in this sector will not only assist the law enforcement agencies in apprehending suspects for security purposes, but it will aid crime prevention around the Hotel premise. Quite several criminal activities have been noted in this section of country hospitality aid, such as abduction, ritual killings, hidden places for arm robbers, prostitution and so on. These activities at times involve staff of hotels where visitors reside. Edu (2014) stated that with today's increasing terror attacks in Nigeria, it is a great concern that hotels must embrace the safety and security of guests and employees. Of recent, there has been increase in the death rate of hotel lodgers, and it is due to the lack of appropriate security measures capable of tracking criminal activities. This is related to the incident that occurred in the year 2021 where a Master's student of Obafemi Awolowo University named Timothy Adegoke died in a Hotel while lodging during his MBA examination. It is of the belief that the introduction of the technological facility in monitoring activities within hotels tends to sensitize both staff and lodgers to desist from criminal acts. This new technique will capture biometric template of each staff. Nataliya (2005) discussed on biometrics unveiling new means of access control in businesses. The work listed several advantages of biometrics to businesses to include: control of access to buildings and rooms, providing clients data security and enhanced service delivery. Some hotels visited during this study uses fingerprints and face recognition for room authentication and access.

3.10 Road Users

The government arm charged with the affair of road operation and management in Nigeria is the Federal Road Safety Corps (FRSC). FRSC is charged with operations such as ensuring the safety of highways for users and vehicles, eliminate or minimizing accidents on the highways and enforcing of discipline and educating road users on certain rules existing on highway use, and check for vehicles which includes road worthiness, insurance etc. The Federal Government unveiled a plan to link citizens' Bank Verification Number (BVN) with their national identity card data in the year 2016 to have a unified multipurpose e-ID card for each citizen (Temitope and Aderemi, 2016). FRSC introduced biometric capturing and process for issuance of driver's license to eliminate problems associated with the old scanning option, which allowed driver's license to be processed by proxy without the applicant biometrics being captured and enable the country track ownership of driver's license and vehicles through the new number plate (FRSC, 2021). This

research helps to know that with the population of drivers in Nigeria, not all the driver has a driver license.

3.11 Pension

The body charged with the management of pensions in Nigeria is the National Pension Commission (PenCom). The Commission is mandated by Section 18(c) of the same Act to "regulate, supervise and ensure the effective administration of pension matters and retirement benefits in Nigeria" (NPC 2020). Even though different bodies were created to carry out different activities, still, monies of retirees have not been able to get to their rightful destination as at when due (Ezuruka *et al,* 2021). Recently in the year 2023, PenCom through its various pension fund administrators (PFA) advised all retirement savings account (RSA) holders and retirees to provide their National Identity Numbers (NINs) and Bank Verification Numbers (BVN), as well and other mandatory biodata information for upgrade. This information was collected alongside capturing of multimodal biometric mode comprising face, fingerprint and signature of each RSA holder's for authentication. This study proposes that introducing biometrics technology capable of liveliness detection will help curb the situation where deceased represented in the pension database are allocated dues and emoluments for ages.

4. RESULT

The findings of this work show that Nigerians are aware of biometric recognition but it is yet to optimally adopt its full implementation. The result shows that the parastatals that have adopted biometrics use in Nigeria are National Identity, Banks, Payroll, Pension, Road safety, Electoral body and Telecommunications while noting that:

- NIMC being the major agent in charge of identity generation for Nigerians, need to address the processing time as the system is time consuming compared to other countries e.g. Indian.
- Okunoye (2022) said with the commencement of Nigerian's national foundation digital identity project since year 2007, only 60 million people had been enrolled as at July 2021. Considering this statement implies that Nigerians with its population projection of 239 million by 2025 (Vitalis and Orunoye, 2021) is yet to fully participate in the NIMC biometric enrollment.
- Biometric fingerprint and face capture need to be automated individually to guard against the stress and time required for visiting the electoral office. However, some citizen's finds it difficult to perform their civic right as the biometric machine fails to recognize them during election.
- Of all biometric features, fingerprint is the most used as noted in organizations visited. Also is face and signature.

- Some banks possess a biometric enabled ATM terminal for financial access in Nigeria.
- Nigeria health system is lagging technologically. Government hospitals are yet to embrace biometrics in recognizing its patients. In this 24th century of global world, majority of Nigerian hospitals uses manual system of record keeping. Nigeria also need to adopt TMIS as in the work of Omid and Morteza (2015).
- It could be noted that Organizations that have adopted biometrics technology in Nigeria still have a lot to do for optimal result to be achieve.

5. CONCLUSION

Nigeria's economy has witnessed a vast range in its transformation from the manual processes to digital; this directly has made living much easier for citizens as they go about their daily activities and transactions. Biometrics systems has played crucial role in various organizations and challenges tends to emerge in its implementation which needs the intervention of researchers to proffer solutions. The introduction of identity number, bank verification number, sim card registration, and other biometric means of identification makes identifying citizens easier thereby reducing fraudulent and criminal activities. Nigerians are aware of the biometric tools but more awareness is required because Nigeria is yet to have an optimal database for its citizen.

6. FUTURE WORK AND RECOMMENDATIONS

There is need to incorporate more biometric features such as iris, voice, gaits etc. where images can be captured with few distance into various biometric systems. It is worthy to note that the emergence of COVID-19 in 2019 sensitized the populace of the need to guard against liquid and very close capturing device for transfer of infection. This leads to the emergence of a contactless biometrics system. It is another trend showing significant evolution since the widespread of COVID-19. Nigeria need to advance technologically as seen in India, China, United States and African countries leading in biometric technology e.g. South Africa, Rwanda, Ethiopia and Kenya.

Our recommendation is in four folds: (1) for identity management sector, government needs to work towards integrating all its organizations, ministries, departments, and sections to have a robust recognition system and reduce redundancy in various databases in different arms within the country. (2) for education sector, biometrics authentication needs more awareness in learning for access control, attendance management, online teaching, fraud detection, security breach etc. (3) E-commerce sector needs to embrace biometrics for efficient service delivery in security, crime detection, access control etc. and, (4) health sector needs to embrace biometric technology recognition for employee and patient identification, prompt and efficient health care, record managements.

Our reflection is that embracing biometrics will help government and stake holders to make informed decision that will aid the growth and advancement of the country as Nigeria is yet to fully embrace biometric technology and its solutions.

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