



## INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

### INTRODUCTION OF FINGERPRINT BIOMETRIC TECHNOLOGY IN NIGERIA BANKING SYSTEM: A KNOWLEDGE-BASED SECURITY PERSPECTIVE

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#### ABSTRACT

Web-based and cash-point/automated teller machine (ATM) fraud has become a common occurrence where third parties gain unauthorized access to customer's fund. A Knowledge management (KM) transformation principles, through the introduction of biometric systems over a communication system could be adopted to enhance security levels and intelligence smart system. A unique biometric system widely adopted in various authentication applications is the fingerprint recognition. This biometric system could be introduced to Nigeria banking system to achieve desired security height for verification and authentication performance. This study present a minutiae-based features extraction to be incorporated into fingerprint recognition security for banking transaction authentication and established biometric technology in the conceptual knowledge management (KM) transformation.

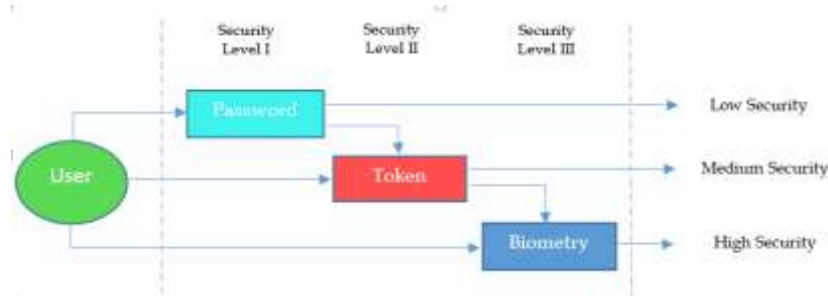
**KEYWORDS:** biometric, fingerprint, authentication and knowledge management (KM)

#### INTRODUCTION

Biometry have increasingly found usage in obtaining identities in business, education and several other facets of life. It provides answers to the question of individual identity and determines authorization and access levels in its applications. It has also found its applications in systems that require secure, solid and dependable authentication methods (Crossmatch, 2014). Ross and Jain (2007) described biometry as a science that finds, confirms and proves the identity of an individual using physiological parameters. Biometry is gradually associated with measurement of human physical and natural pattern presentation. These patterns include fingerprint, iris or retina, gait, palm print, face recognition, voice and veins (Bharadwaj *et al.* 2014). Human personal parameters are captured as data to be analyzed in a form, and stored for use in authentication.

In the business world, biometric technology has been adopted as supporting levels of authentication - usually a second or third level authentication, buoying up security provisions made by password, tokens. This is for reasons like its uniqueness to every user and because it can neither be forgotten, damaged, lost or stolen like password and tokens. Figure 1 illustrates security enhancement height that could be provided by systems that adopts biometry.

**Figure 1**



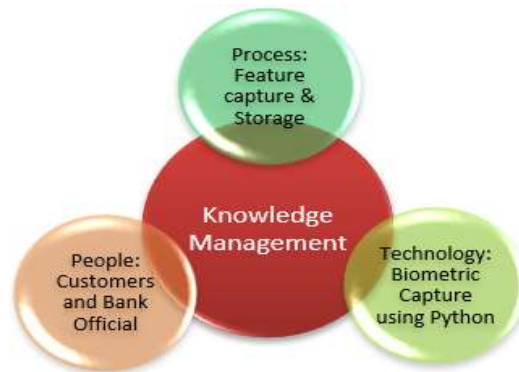
*Security enhancement through biometry*

Engineering knowledge management (KM) refers to processes that deliberately and systematically collects, organize, shares and analyzes knowledge in terms of resources, documents and skills (Lynos, 2000). It forms the basis for the deployment of knowledge on the principles, processes and application of biometry. This paper, while focusing on the fingerprint biometry system, present minutiae-based feature extraction method in the conceptual knowledge management transformation system.

### KNOWLEDGE MANAGEMENT (KM) CONCEPT AND BIOMETRY

The study adopted knowledge management (KM) skill to present a security conceptual blueprints for organizational knowledge and process. Apena *et al.* (2014) stated that application of KM techniques can reveal meaningful interaction of people, process and technology to enable knowledge communication as shown in Figure 2. Organizational challenges dictate height of interaction of bring process and technology relatively to people in question (Bhojaraju, 2005).

**Figure 2**

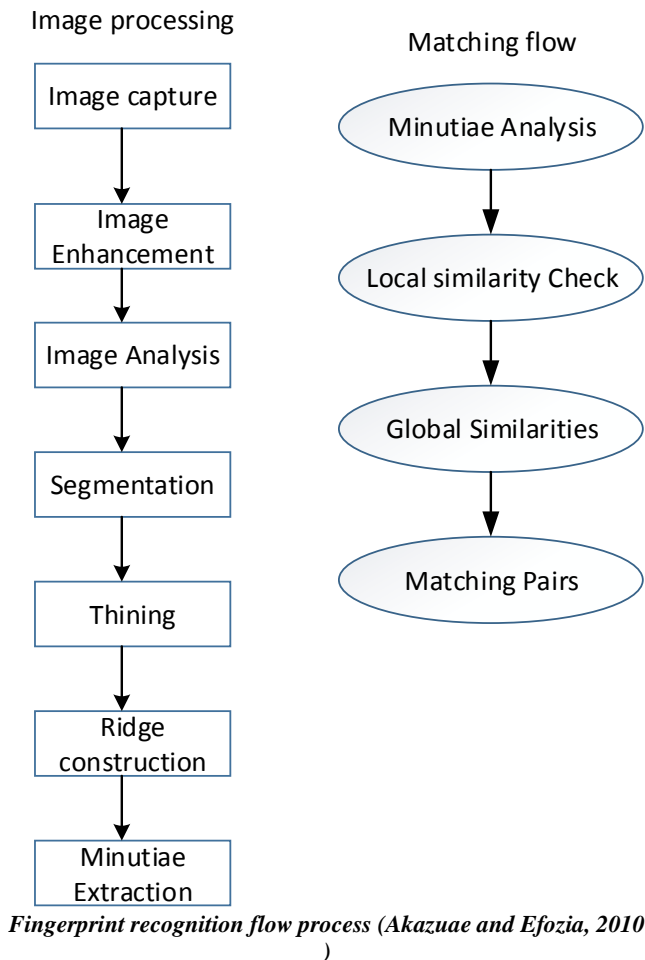


*Knowledge Management Model*

### KM Interaction and Fingerprint Biometry

The utmost aim of biometry is to secure and approve data verification to enhance security. KM interaction could support data transmission, storage and development of appropriate technological process for data identification in a global digital view. However, data protection militate the height of security with respect to concern professional. Knowledge management applications revolve round the knowledge creation to the transformation stage of process and people. 'People' component poses a challenge in knowledge management transformation due to individual interest and educational diverse. Designing a biometry process to support security height will require organization policy disintegration and awareness of people involved. The process in fingerprint biometry initiates from data/image capture routine to the pre-processing (image enhancement, analysis segmentation, thinning,) extraction, storage and data call-up, matching as a knowledge transformation process. Figure 3 illustrate image processing flow and matching algorithm.

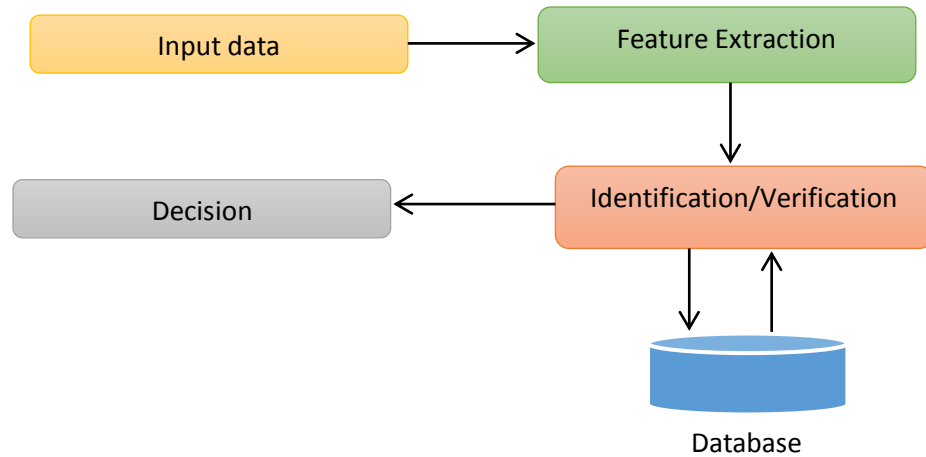
Figure 3



Akazuae and Efozia (2010) described efficient biometry system as a function of available technology to determine the following based cost, flexibility, robustness and user-friendliness. Current technological status in Nigerian banking system could support digital activities (transaction) using biometry security gateway. Although, biometry security system could require an intelligence verification system and ever ready network to support real time operation. Application of KM-biometry procedure could address banking disjointed knowledge to enhance operational security in Nigeria.

**Knowledge Transformation Technology (KTT)**

Knowledge transformation technology is a viable organizational communication link between people and information (Servin and De bruns, 2005). KTT interpret evolution process of knowledge creation, sharing, modification, data storage and retrieval (Bhojuraju, 2005). The core ‘technology’ component is the fingerprint matching module. The fingerprint module deploy use of python (software), a Network Programmable Interface (NPI), to create communication link between the user and the biometric engine. The technology capture could data and comparatively checked against stored data to complete verification process.

**Figure 4***Fingerprint authentication system*

The advantage of knowledge management (KM) in this applied initiative is that it borrows from laid down basics and gives the needed guide in the knowledge application. The discovery that fingerprint can be applied to fortifying security in banking sector. This initiative (application) could be supported with KM concepts with respect to available technology and process. Documented/tacit knowledge could be adopted in the implementation of the technology and verification process.

## BIOMETRIC TECHNOLOGY

Biometric technology is a programmed system of procedures of measuring personal traits and physiological parameters associated with individual, and comparatively linking with initial database biometric sample(s) in the conceptual knowledge management manner as proof of identity (Akazuae and Efozia, 2010). Fingerprint biometric technology could support verification and authentication of personal trait parameter to enhance security; these process also known as ‘one to one’ matching; while the identification process is refers to as ‘one to many’ matching (Bharadwaj *et al*, 2014). Identification, verification and pattern recognition involve knowledge technological-based processes to support individual feature extraction and storage.

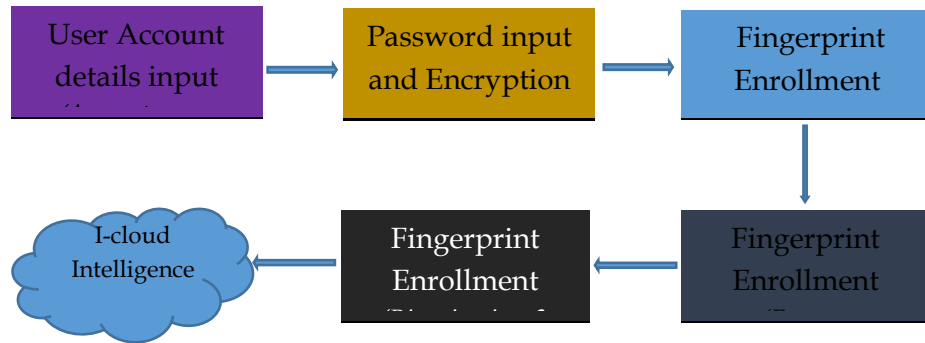
### Knowledge Creation and Problem Identification

Over the years, security provisions in organizations have been found to be knowledge gap, these include some laxities as security disjointed knowledge of granting unauthorized accesses to highly security places and database. Hackers and fraudsters have perpetrated varying degrees of frauds that have become so costly to organizations and security threat. Financial industries appears to be the most affected organization such as banking and insurance sub-sectors. Knowledge-based application of fingerprint biometric system in banking could ultimately provide controlled access to customers’ funds. The system does simultaneous multiple processes of identification, verification and authorization to either grant or denied access. This level of security could be added to the existing PIN/password security in Nigeria banking system to provide additional platform for security evaluation and authentication.

### Fingerprint Module Development

There have been observable concerted efforts towards beefing up security on the ATM machine including the use of passwords and snapshots, but with the use of fingerprint biometric systems, could be bound to be an improved security measure. The proposed system can be an incorporated module of sensor(s) for data acquisition including inputs and output distributed devices with network programmable interface (NPI). The enrollment process can be carried out by capturing fingerprints of customers, extracting the features using the minutiae extraction approach, creating a template then fingerprint information is stored in a secured database system.

Figure 5

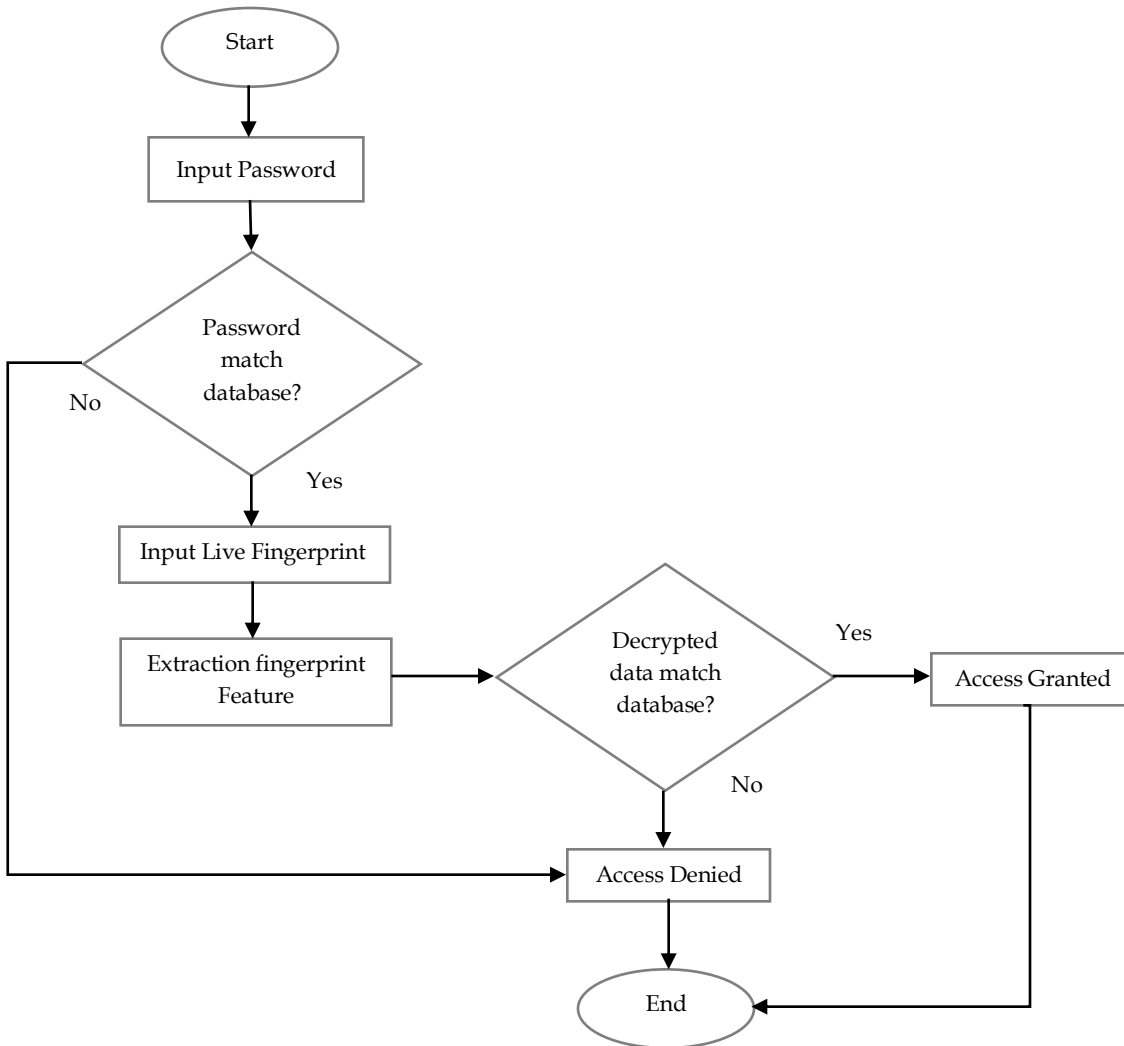


*Knowledge-based Fingerprint Enrollment Process*

**Robust Biometric Module and Database System**

There are quite a number of sensor modules readily available for fingerprint biometric data acquisition such as thermal, optical, capacitive but an apposite capacitive sensor is proposed in this paper to capture crude biometric samples and images. The scanner was chosen due to its efficiency for feature extraction mechanism and most importantly the ability to get integrated into the ATM machine’s NPI. Database is the store house of the captured biometric data and knowledge creation system. Biometric data will be captured and stored as a created initial knowledge during enrollment including extracted feature(s). Data are expected to be stored in i-cloud intelligence database system for real time operation(s) with specific identifiers linked to individual customer’s information and details.

Figure 6

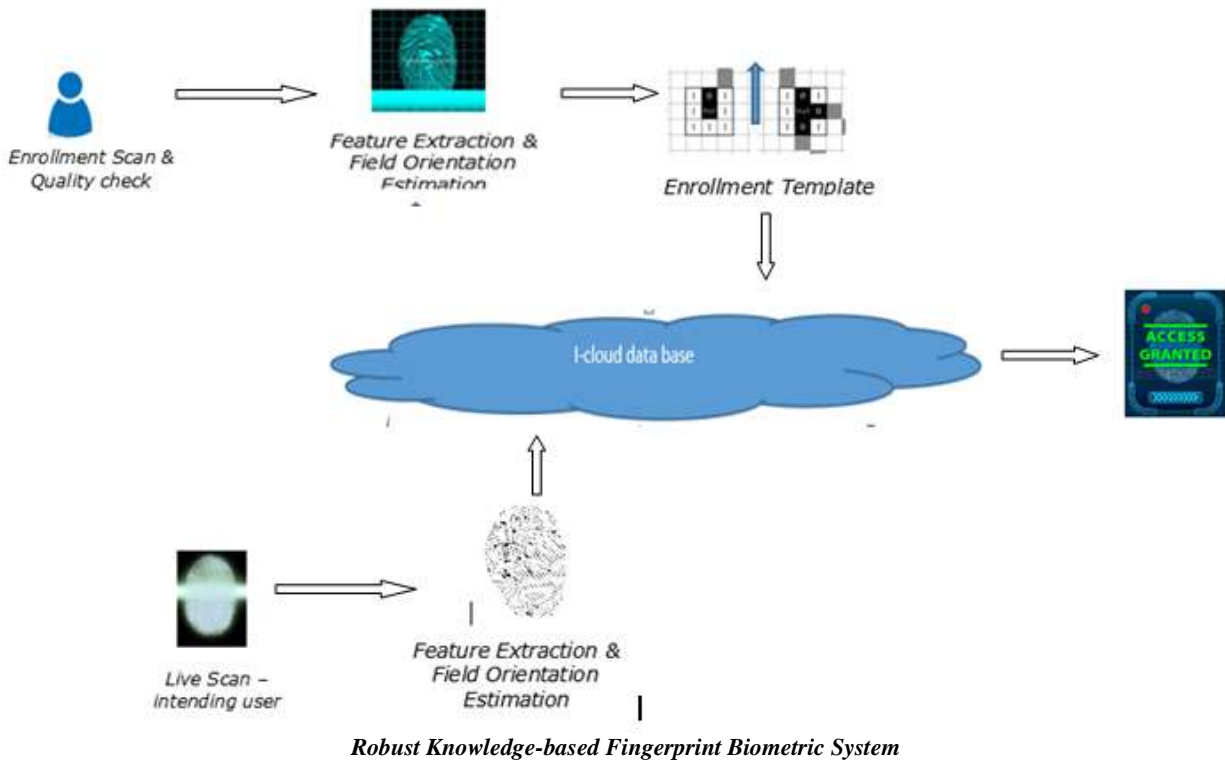


*Fingerprint Biometric Process Flowchat*

**Operating System (OS) and Network Programmable Interface (NPI)**

The fingerprint module could be structured in compatibility with different operating systems but for ease of usage and simplicity, the Microsoft windows 8(64 bit) is suggested. This is also due to the fact that most ATM machines currently available runs on same platform; while the initiative integration could be seamless. Network programmable interface (NPI) is expected to unify an intelligence robust system of information sharing. The Python is suggested to be intelligence NPI of choice due to its affinity, such as being user-friendly, adaptability and its compatability to ATM machine’s (cash points) with respect to operational availability and cost. Figure 7: Robust Knowledge-based Fingerprint Biometric System reveals the overview of the proposed system.

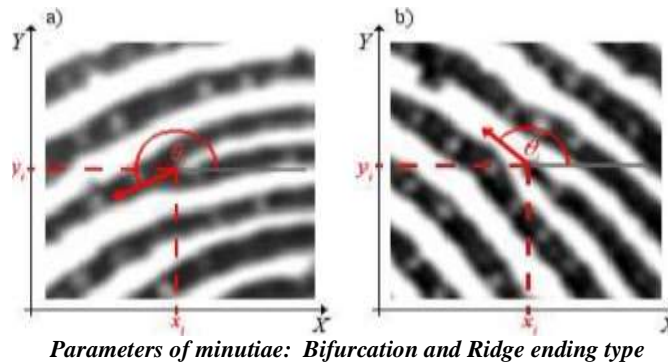
Figure 7



**Physiological Access Control and Feature extraction**

This work present a physiological parameter (fingerprint) approach to access control. The system will be able to perform high level quality security check to ensure a resolution to produce a verification match comparatively to the database. Feature extraction method deployed to efficiently apply minutiae based fingerprint recognition process. The process includes thinning and minutiae extraction for better feature extraction verification and identification. Estimations could be expressed as shown in figure 8 (parameters of minutiae) in terms of coordinate minutiae (x, y), direction d, and type t.

Figure 8



**Fingerprint Pre-processing and Minutiae Extraction**

Fingerprint image is acquired and converted into greyscale to support binary data operation. The binarized image is thinned to reduce the thickness of all ridges lines to one pixel width to support extract minutiae points analysis. Edge enhancement algorithm used to thin the edges of the ridges. This step derives the minutiae locations and angles to achieved crossing number (CN).

A relationship between the intensity values of two adjacent pixels is established to identify the minutiae points. If crossing number is 1, 2, 3 or greater, then the minutiae points are considered as ending, normal ridge, bifurcation respectively using equation 1.

$$CN(x, y) = \frac{1}{2} \sum_{i=1}^8 |(p_i - p_{i+1})| \dots \dots \dots (1)$$

### Matching and Verification

At the point of access fingerprint images are superimposed and comparison is made. Fourier transform application could be adopted to compute the correlation between the input and the already scanned image. If the finger print matches any in the database, the system goes on check its access level to identify if the user is the account holder or any disparity. Once this is ascertained based, authentication process commence: the entrance, the user's attempts to access and the system grants access or denies access.

### KNOWLEDGE DEVELOPMENT USING BIOMETRY IN NIGERIA BANKING OPERATION

Significant improvements have been made to fortify security of customers' data in Nigeria banking system. The initiative of knowledge management (KM) gives opportunity to address gap as a knowledge creation in order address challenges as a new development. Although, Nigerian baking system require total automated innovation to synchronized with world class standard. The introduction of fingerprint biometry in the Nigeria banking system could boost the security requirements and also provide knowledge development. Introduction of fingerprint biometric as a KM initiative could secure a better baking community in Nigerian financial sector and broaden managerial knowledge. A centralized database system for Nigeria banking system could strengthen product and service reliability on loan and overdraft. This could significantly have positive implication on the national economy. KM initiative could provide futuristic technological based automation system, as a positive solution to address knowledge gap(s).

### CONCLUSION

The paper has presented a knowledge management (KM) concept to enhance biometry knowledge-based application in Nigeria banking operation. The research investigated possibility of introducing fingerprint technology to aid operational efficiency and address security issue in the conceptual view of KM (people, process and technology). The consideration to adopt biometric fingerprint for verification and identification of individuals (customers) in other to access (authentication) account could increase banking security. It was proven that fingerprint technology is a unique physiological index (parameter) which can be adopted to strengthen Nigeria banking security system. Adopting fingerprint security could address fraud and security issues associated with account operations such as unauthorized access to third party accounts.



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