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Hybrid Banking ID authentication Using Novel Fingerprint Sensitive Pen

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Abstract— Identity verification plays an important role in banking system. Its role is fast increasing even with the advent of online banking system. As such, its role in checking signature forgery, identity theft and frauds is paramount. In addition, the ever increasing number of transaction documents (cheques, deposit slips, tellers, electronic transfer forms etc.) that banks have to process on a daily basis is high most especially in commercial banks. To this end, there is need for a more dependable, easily deployable and efficient system that mimics the bank identity verification system. In this work a novel fingerprint sensitive pen is proposed with necessary design specifications. The pen creates a novel hybrid approach to identity verification. To further improve on this work, the implementation phase of the fingerprint sensitive pen should be the focus. This will result in a product that is commercially available for banks to deploy.

Index Terms—Fingerprint, Signature, Hybrid ID Verification, Fingerprint Sensitive Pen, Bank.

I. INTRODUCTION

Verification primarily has to do with comparing a key to what is stored in the database. This key could be in different forms varying from smart card information to human physiological and behavioural characteristics. The higher the system integrity the lower the rate in which the keys forms can be compromised. As such, some systems combine two or more security mechanisms in order to reduce the rate in which the system integrity can be compromised. Banking system is one of the systems that use verification method. One of the key areas where this is done is in identifying authentic signatures from forged signatures. When customers tender cheques and cash withdrawal slips to the cashier, the cashier puts the tendered document through a verification process in which he or she verifies the signature and further categorizes it as genuine or forged. A customer with genuine signature will be credit or debited as the case may be. In Nigeria, categorizing a signature as genuine and forged is based on the cashier's judgment which might be wrong or might even be bias in nature. To this end, there is need for a more accurate, efficient and reliable method which can be readily deployed in a banking environment. Integrating fingerprint into the available system will further help to increase the system integrity. This paper is based on a hybrid identity verification method which includes handwritten signature and fingerprint usage as solution to only human -judgment based identity verification method in banking system. The recommendations in this work are based on deploying a fingerprint sensitive pen. This paper is thus organized: firstly, selected methods of signature verification and fingerprint verification are reviewed. Followed by a detailed description of a hybrid identity verification methods in some sited systems. In addition, verification in banking system is considered. Lastly, a detailed description of a novel finger print sensitive pen in banking system is described.

II. SIGNATURE VERIFICATION METHODS

Signature is categorized as behavioural characteristic of human being. This can be captured using online or offline methods. Online signature capturing has to do with collecting all the signature dynamic properties such as pressure, x and y coordinates, speed among many other. [1] Online signatures are captured using a signature digitizer otherwise known as signature tablet. While offline signature capturing is primarily aimed at signatures signed on a paper document. For further computer vision verification, the signed signature is scanned using a scanner and then passed to already prepare computer codes for further processing. [2]

This is work; offline signature capturing method is relevant. This is a situation where the bank customer signs on a cheque, a withdrawal slip or a bank deposit slip for transaction purposes. In Hand Written Signature Recognition and Verification Using Neural Network, Pradeep Kumar et al, 2013 the work shows that signature are considered as the most natural method of authenticating a person's identity. It further stresses that signature plays important role in financial, commercial and legal transaction. In addition, signature was considered as 'seal of approval' and



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most preferred means of authentication. MATLAB was used for implementing the verification algorithm for the system designed [3]

Furthermore, in Vertical Offline Signature Feature Block for Verification, S. A. Daramola et al, 2014 states that handwritten signature is used as mark of endorsement. As such, 50 individual's signatures were collected to form signature database. 6 signature samples from each person were collected. These signatures were filtered, converted to binary, thinned, converted to vertical image blocks of 2, 4, 8 and 16. The signature was verified using support vector machine. The system was found to work according to design specifications. [4] Ashok Kumar and Dhandapani, 2014 shows that bank cheque could be verified using offline signature strategy. They argued that since major business transactions are carried-out using the bank cheques, it is important to digitize the process of verifying the signatures in order to reduce the time consumed in manually verifying cheques. The work further affirms that the manual signature verification is time consuming. The system designed in this work uses the Levenberg-Marquardt back propagation algorithm in training the Artificial Neural Network deployed. The system was tested with 120 genuine signatures and 120 forged signatures. The system accuracy was 92.08%, sensitivity of 93.25% and specificity was derived to be 91.12%. [5]

III. FINGERPRINT VERIFICATION METHODS

Fingerprint verification is categorized under physical biometric type. Seema Rao and Prof. K.J Satoa, 2013, shows a description of fingerprint verification method in an attendance system. The work presents three types of fingerprint patterns which include; the arch pattern, loop pattern and whorl pattern. Minutiae matching and pattern matching methods were discussed when it comes to matching the captured finger print with those in the database. The worked further developed a fast and swift verification by minutiae technique because its more popular and widely used. A system was further developed for fingerprint scanning and registration, recognition and authentication and attendance update. [6]

In the same vein, Adewole et al, 2014 sheds more light on applications of fingerprint verification system. The work shows that fingerprint verification system is applicable in banking, staff attendance, identification and verification of criminal, education, health, fighting terrorism and immigration. In implementing the verification system in the work, Microsoft VB .Net programming language is used. Attendance reports were generated using the enrollment details such as fingerprint, name, sex marital status, occupation state of origin, house address, ID details etc. These are also applicable attendance enrollment details in a banking verification system. [7]

IV. IDENTITY VERIFICATION APPROACHES IN BANKING SYSTEM

The sensitive nature of banking activities makes the choice of verification method adopted to be an important topic on the global scene. Edward J. Potter in his work on Customer Authentication: The Evolution of Signature Verification in Financial Institutions gave a clear description of various authentication challenges, and solutions that are applicable in a banking environment. Bank concern on who designed and developed a software to be deployed was on the rise as banks first gave thought to internally designing banking applications. But as functionality and acceptability of the developed software became a concern in curbing the increasing identity theft, banks gave thought to contracting the software applications development to trusted vendors. This giant step by bankers seems not to curb identity theft as envisage. A report published by ABA in 2000 shows that cheque fraud was about \$2.2billion. \$1.5 billion was avoided losses which the actual losses stood at \$679million. These losses was as a result of forged signatures, counterfeit cheques, identity theft, internet based transactions and debit cards. [8] In addition, the work stress the importance of signature verification, optical scanning, LID ink and bar codes on cheques, identity card presentation, PKI and physical identity as identity verification methods in checking authentication fraud. More recommendations were given; such as documenting more information about customers, standardization of fraud curbing methods and banks should have more effective centralized information sharing approach. [8]

V. RELEVANT WORKS ON HYBRID VERIFICATION IN BANKING

A. *Designing a Biometric Strategy (Fingerprint) Measure for Enhancing ATM Security in India E-Banking System [9]*

This work presents dual approaches to customer verification when using the ATM. These are fingerprint and conventional ATM pin verification methods. In addition to the aforementioned approaches, the work further suggests that physical presence of bank security officials will go on long way to further improve the integrity of the

process. It was further noted that fingerprint is one of the most mature and proven method when it comes identification. The system developed was tailored towards the withdrawal interface of the ATM. The system caters for customer balance notification, account balance retrieval, insufficient fund retrieval and successful withdrawal notification platform. The system is capable of reducing fraudulent activities in relation to the ATM e-banking process. [9]

B. Role of Biometric Technology over Advanced Security and Protection in Auto Teller Machine [10]

Also, this reviewed research paper proposed a dual user verification system due to increasing ease of fraudsters performing fake transactions on customers account. The work shows various biometric technologies that could be deployed to achieve the dual verification and authentication it promotes. Furthermore, bank authentication stages were highlighted which include, what we have, what we know and what we are. These three basic questions spearhead the authentication process in a typical ATM. Also, the working principles of fingerprint, iris/retina scanning, and vein pattern recognition and face recognition were discussed in [10]. Conclusively, the work proposed the usage of PIN and biometrics for ATM verification. Fingerprint was noted to be the most popular and widely applied biometrics technology in ATM. [10]

VI. PROPOSED FINGERPRINT SENSITIVE PEN IN BANKING

A. Fingerprint Sensitive Pen and its Parts

The proposed pen has the capability to capture its holder’s fingerprint as such verifying the person’s identity with reference to a linked database. The device is proposed to be powered over USB. The pictorial representation of the pen is as shown in figure 1.

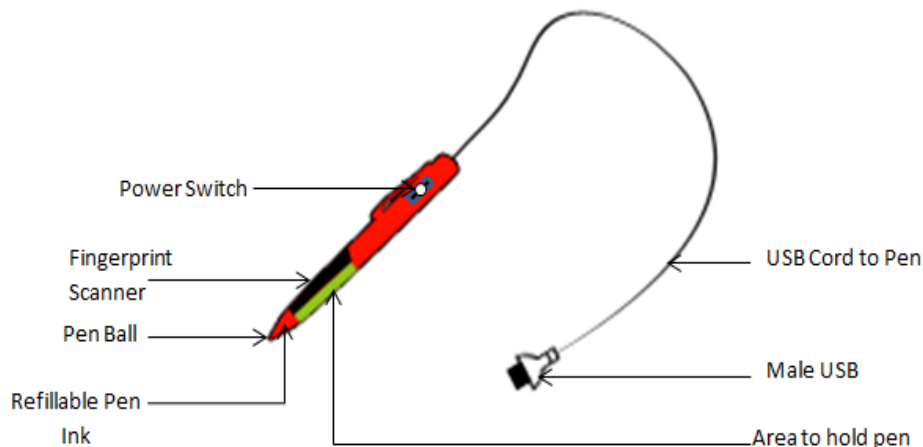


Fig 1: Proposed Fingerprint Sensitive Pen

The following define the parts of the proposed pen:

- Power Switch: The basic function of this switch is to toggle the power supplied to the device on and off.
- Fingerprint Scanner: Its function is to scan the pen holder’s signature for further processing. The proposed scanning method for this is Capacitance Scanner. This is due to its ability to any form of reject fingerprint images other than the real on-the-finger-prints. This is its major advantage over Optical Scanner method.[11]
- Pen Ball: It is the usual pen ink dispensing method in ball pens. Ball diameter is 1mm and clearance between the ball and socket is recommended to be between ¼ to 5microns. [12]
- Refillable Pen Ink: This refers to the ink in the ink compartment of the pen.
- USB Cord to Pen: The USB provides connection to a centralized backbone computer that carries out the verification and authentication process. USB 1.1 full speed specification of 12Mb/s transmission rate is recommended. In addition, plug and play functionality is recommended. [13]
- Male USB: This is the USB terminal that is designed to fit into the female USB ports in computer to establish inter device communication.



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- Area to hold: This also points to the fingerprint scanner surface.

B. Hybrid System Block Diagram

The proposed system hybrid design focus on a simultaneous processing of the two captured customer properties (handwritten signature and fingerprint), verification and authentication/ rejection stages. On the fingerprint verification segment in figure 2, the fingerprint the system has successfully captured in passed through preprocessing stage, feature extraction, access and storage of the captured features vector into the database for further verification, calculation of accuracy level process, execution of an if-clause that is targeted towards to a set acceptability threshold and execution or rejection of the transaction as the case may be. Also, the handwritten signature verification follows similar procedure. It is important to note that the captured handwritten signature could be processed based on the cashier/ assigned banker's judgment or using the offline signature verification system. The former, has a major disadvantage as experience and number of cheques/ transaction documents to be verified per-day counts which is directly proportional to the integrity of the verified transaction documents as advised by Edward J. Potter, 2002. [8] Therefore, the offline signature verification is recommended.

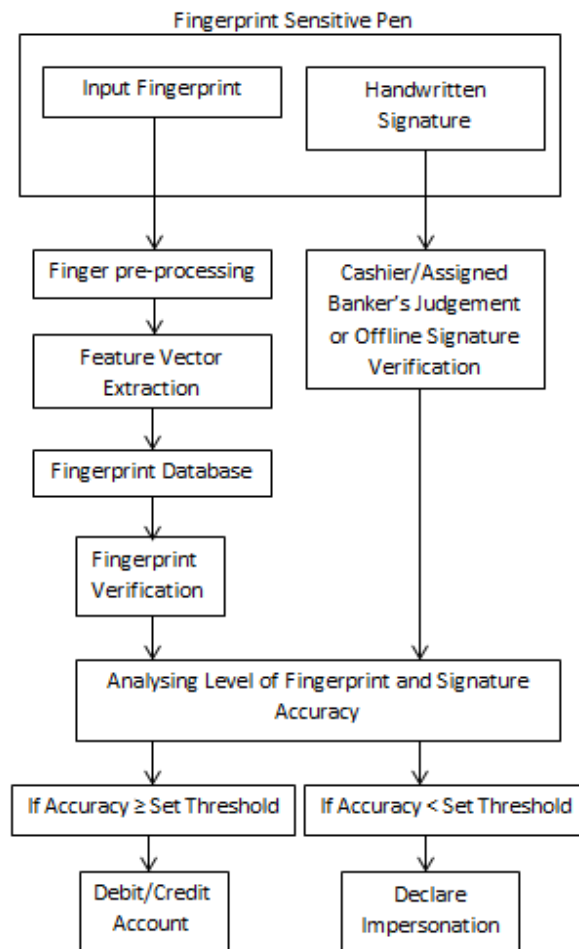


Fig. 2: Hybrid System Block Diagram

C. SDLC Model and System Integration

The system integration is at result analysis and authentication stage as shown in figure.3. In addition, the proposed Software Development Life Cycle is the Waterfall Model because it is easier to implement compared to other SDLC models and it has a feedback design to the pre system requirement (analysis) stage. This is to make sure that the design and implementation outcome is according to the earlier system analyzed requirements. This is illustrated in figure 4.

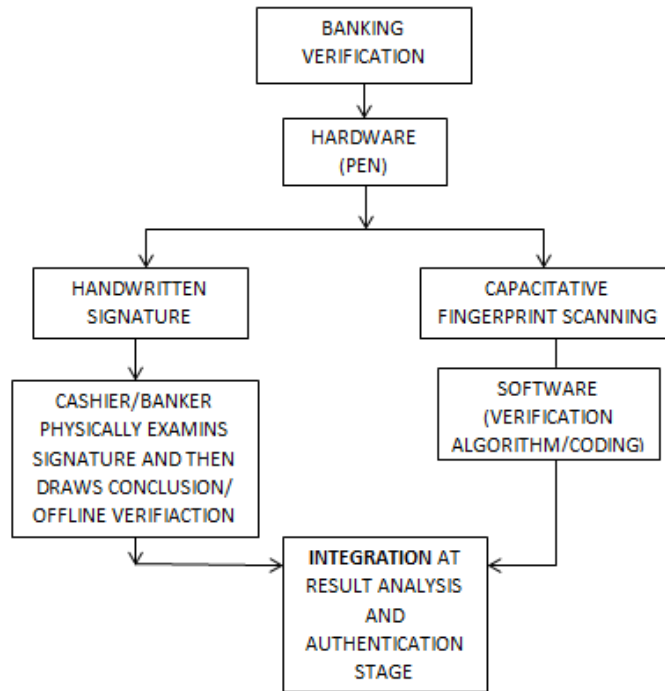


Fig. 3: System Integration Diagram

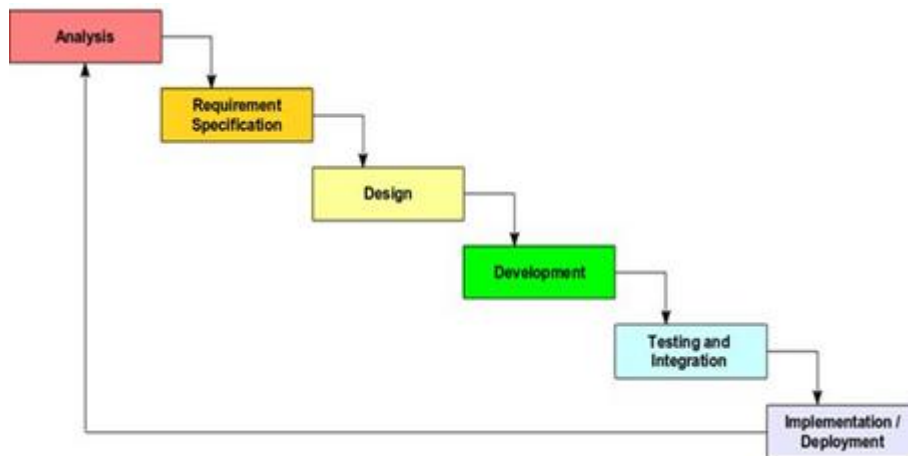


Fig. 4: Proposed Waterfall Model [14]

VII. CONCLUSION

Conclusively, this work has discussed different signature and fingerprint verification methods, the place of identity verification in banking system and relevant works on hybrid verification in banking system. Furthermore, a novel fingerprint sensitive pen was proposed with its design specifications using a well explained pictorial representation, detailed block diagrams and a recommended Software Development Life Cycle model, Waterfall Model. The proposed hybrid fingerprint sensitive pen is capable of proffering solutions to various identified challenges as it relates to fraud, identity theft and forgery in a banking system. An improvement on this work will be focused on implementation of the proposed fingerprint sensitive pen.

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