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- Schemenner, R.W., Huber, J.C. and Cook, R.L. (1987), "Geographic Differences and the Location of New Manufacturing Facilities," Journal of Urban Economics, Vol. 21, No. 1, pp. 83-104.

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RURAL E-BANKING: A TECHNICAL FRAMEWORK USING MOBILE TERMINALS**DR. V. B. AGGARWAL****DIRECTOR (IT)****JAGAN INSTITUTE OF MANAGEMENT STUDIES****DELHI****DEEPTI SHARMA****ASST. PROFESSOR****JAGAN INSTITUTE OF MANAGEMENT STUDIES****DELHI****ARCHANA B. SAXENA****ASST. PROFESSOR****JAGAN INSTITUTE OF MANAGEMENT STUDIES****DELHI****ABSTRACT**

For betterment of rural India, there is a need of secure and contented financial services. Current bank branch network is not able to reach these areas and even if they try to do so, it will cost more for both bank (for setting up a branch) and customer (for accessing services; e.g. travel and queuing time). Branchless banking has potential to achieve this target in limited budget but current structure of branchless banking also needs some improvement to enhance security and avoid fraudulence activities. To attain this objective a framework is offered where branch less banking is provided through Wi-Fi enabled mobile terminal, local villager/Agent and bank. Together they will act as a virtual branch which further connects over internet with customer database of main stream banking system such as SBI, PNB, and BOI etc. In this scenario agent authentication is done through VPN token and for villager smart card is used. At the end of every transaction printed slips with all necessary details are taken for legality of transaction and saved in database for records keeping audit trail as well. It is a simple and secure that uses m-banking, i-banking and can be easily understood by unsophisticated and non technical villagers.

KEYWORDS

Rural banking, e-banking, VPN Token, Smart Cards, Mobile Terminals, Banking Correspondent, Branchless Banking.

INTRODUCTION

Banking is always important to our society but in last few decades' Indian banking has seen major transitions from traditional physical financial structure to e-banking, i-banking and m-banking by using technology to provide better services. These services have become popular in metros and major cities in India but in rural India still old methods like operating account through local branch are used. Rural people living in the village are forced to avoid it or have to travel to the city for using these banking facilities. Although for uplift of rural banking structure and provide more facilities to rural India Finance Minister Pranab Mukherjee had said in his Budget speech that all villages with a population in excess of 2,000 would get banking facilities by March 2012. (Hindustan Times, 2010). Placing a Brick and Mortar branch in every village will be highly time consuming and need huge investment in terms of infrastructure and technology. We know computerization is expensive and need huge investment in software, hardware and maintenance. Moreover like west, India is also at high risk of computer crime, so security also needs high investment.

For rural India to make such facilities useful, we need to give an IT infrastructure where initial cost of setting up the framework is not very high and technology awareness is not a major hurdle to use these facilities. In last three decades, RBI and Govt. of India have taken mutual steps for universal access of financial services. One such initiative is branchless banking. Branchless banking is a concept of providing banking services outside the conventional bank branches by either using information and communication technology services or third party organizations (Sharma, Subramanian and Shasha, 2009). Branchless banking has following characteristics (Gautham and Ignacio, 2008) (i) Mobile Phone and Payment cards are used for recording transaction and communication with banks. (ii) Third party or agents act as middle man between bank and villager and handle cash for withdrawal and deposit. (iii) Minimal banking services (deposit and withdrawal) are offered. Branchless banking is available in bank based and non bank based models. In bank based model, every customer has direct relationship with prudentially licensed and supervised financial institution but the same direct relationship is not required in non bank based model Only bank based models are permitted in India (CGAP, 2010). Branchless banking channels include (i) ATMs, (ii) electronic banking based on the Internet, (iii) banking correspondents and banking facilitators, and (iv) mobile banking (CGAP, 2010). In the current scenario a resident of the village who has sufficient liquidity and phone act as bank agent and called as shopkeeper. Others in village perform transactions (withdrawals and deposit) with him (Kumar and Gupta, 2009). As everything is in hand of shopkeeper and no security or authorization procedures are used so possibilities of fraud are legion and villagers don't trust these shopkeepers. To match the simplicity of farmer and ensure security, we have developed a protocol framework where a banking correspondent or third party agent authorized through VPN token will act as a branch of bank in several villages Villagers' use a smart card with biometric details for identification

This paper is organized as follows: **Section 2** Listed findings from existing literature **Section 3** defines problem in existing system **Section 4** illustrates System Architecture and Components of the framework. **Section 5** explains working of framework. **Section 6** explains security feature of proposed system. **Section 7** explains conclusion and future work and **Section 8** list references that are related to this research work.

REVIEW OF EXISTING LITERATURE

In order to write the proposed framework, existing literature of current topic is studied and few findings of this review are as follows: Traditional banking in rural areas does not work well (Gautham, 2006). Recent literature address key issues about e-banking are: customer acceptance and satisfaction, privacy concerns, profitability, operational risks, and competition from non-banking institutions (Boss *et al.*, 2000). Now a day's traditional banking has taken a turn to e-banking, m-banking and i-banking. American bankers are first few in international banking to launch e-banking in early 1992 (American Banker, 2000). Empirical studies from the consumer side of e-banking have been reported recently, such as one focusing on the quality of customers on the utilization of current e-banking services (Hitt and Frei, 2002). One more empirical study is completed through web based survey shows there is huge potential for small and local community bank to improve their e-banking services. Majority of those small local community banks (about 57%) have a low e-banking customer rate of less than 30%, and only few banks (about 7%) have a 60% or higher of their current customers using their e-banking services. While a third (36%) has only 30% to 60% of their customers using e-banking services and none has a proportion over 80%. (Yang, Whitefield and Boehme, 2007).

Major risks associated with i-banking are checking identity and authorization of person performing the transactions online. So financial institutions using i-banking require to identify types and levels of risk associated and need multifactor authentication, layered security or other controls reasonably calculated to mitigate those risks (Federal Financial Institutions Examination Council, 2005). In a country like India customers are reluctant to join online services that contain little risks, so banks should concern security and privacy issues while designing a website for account operations (Dixit and Dutta, 2010).

The Report of the Committee on Financial Inclusion (2007) reveals that, despite a large banking system and cooperative credit network, many poor households in India lack access to financial services (CGAP, 2010). About 80% of India population lives in rural area and don't have good banking facilities. So, Financial Infrastructure of rural India needs support of Branchless banking to get achieves maximum aim in limited budget (Sharma, Subramanian and Shasha, 2009). A survey conducted in Brazil shows that around 90% of those surveyed used agents to pay their bills. Also, around 78% of the financial transactions are conducted through 95,000 agents distributed over the country (CGAP, 2006). WIZZIT is a successful mobile banking provider in South Africa that has seen its user base increase over the years. RBI is also taking initiative to provide branchless banking in rural areas so that villagers don't have to move 20-30 km to use banking facilities. According to a World Bank Consultative Group (CGAP), branchless banking is cheaper than traditional banking method (Gautham and Ignacio, 2008). The operationalization of the Finance Act 2009 in January amended the Banking Act, allowing banks to use third party agents such as petrol stations, supermarkets, shops, Saccos and small retail outlets to reach the unbanked [James Anyanzwa, 2010]. Branchless banking is 19% cheaper than comparable products offer by bank through traditional channel (CGAP, 2010).

PROBLEM FORMULATION

Branchless banking aims to serve rural India, but how much it has achieved in last few years is question which is to be answered by our financial institutions. Despite of all efforts, we are still not able to give a transparent and trustworthy banking infrastructure to our rural customer where they can easily perform their routine transaction in secure and cost effective environment.

Recently, Finance and security experts have raised questions about lack of security in rural banking models. Experts are not very much satisfied with security standards used in rural banking and believe secure and simple environment can bring more rural population to banks (Bangudu, 2009). Techniques used to provide banking facilities in rural areas and not very comfortable for not so technical and mostly uneducated villagers and expected results cannot be drawn from current investments.

ATM is one of the forms of Branchless banking (BLB). Finance Minister Pranab Mukherjee aimed to install ATM for bank transactions in villages where population is more than 2000 as said in his budget speech. (Hindustan Times, 2010). Setting up an ATM is low cost as compared to setting up branch for handling cash needs of villagers but uneducated rural customer require assistance to operate these ATM machines. The RBI circular no. BP.BC.60/21.03.051/96 specifies that "no person other than the security guard should be posted at such "non-branch"/"stand-alone" ATM centres" (CGAP, 2009). Hence banks cannot employ any assistance to support customers.

To overcome password related problems (forget password), Govt. of India has also taken initiative in installing token less identification or biometric ATM's where a person's speech, face image or fingerprints is used for the identification. But what about the issue when person is not able to read the instructions written on ATM. Deposit through these ATM's is not very easy. For deposit one have to leave cheque in the drop box after writing name and account details on the back of cheque without getting any proof of dropping it. In case of non-credit of cheque, he cannot enquire bank about deposited cheque as he don't have any proof.

Another form of branchless banking is bank correspondent or bank facilitator. In this concern major issue is consumer protection. Adequate regulatory provisions are required to minimize chances of fraud by third party. More and more technology advancement is used to make the procedure secure but this advancement can create problems for not so technical advance villagers At times these legitimate agents also defraud customers and providers (CGAP, 2009).

Innovation is the key to solve all these issues and expand frontiers of formal financial services by administer security in rural India through simple biometric system which is easy to understand and simple to follow:

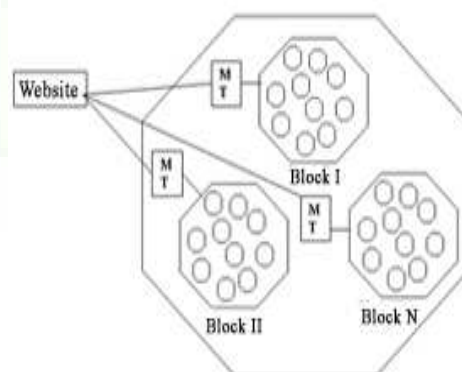
The main objective of this study is to propose a Framework that can answer the following issues:

- 1) How to provide easy access of main stream banking facilities to villagers in remote harder areas.
- 2) Credibility of proposed banking framework.
 - a) Avoidance or reduction of fraudulent activities.
 - b) Safe environment required for MT BLB agent.
- 3) How to enhance security aspects of Branchless Banking (BLB)?
- 4) When and how to update main stream bank records?
- 5) Cost control by leveraging present IT and Telecom infrastructures.
- 6) Efficient functioning/operations of Govt. Schemes for BPL and APL households.

SYSTEM ARCHITECTURE AND COMPONENTS

Keeping above discussed problems in mind, we have proposed a framework for rural India where villagers can avail BLB services with minimal efforts, door-step availability and improved security measures. Anticipated framework organizes villages into blocks on the basis of geographical proximity. Each block may consist of few (max. 10) villages. One **Agent** with **MT** is responsible to provide service to all villages belonging to that block and provide balancing service to AH in each village on different days of the week.

FIG 1: BLOCK FORMATION ON THE BASIS OF GEOGRAPHICAL AREA



Proposed model consist of BLB Agent, Account Holder (AH), Bank Database on secure website, Mobile Terminal (MT), VPN token and Smart Card for AH.

BLB AGENT

BLB Agent registers himself with bank for offering his support to villagers on behalf of bank. After ensuring liquidity details and knowledge about current technologies (that are required for smooth working of assigned responsibilities) bank issues an identity to BLB Agent which includes unique number,

demographic details and finger prints of agent are recorded digitally. Using VPN token and MT, agent authorizes himself to bank for accessing related data and executing transaction on behalf of AH.

ACCOUNT HOLDER (AH)

When a villager opens an account with bank, a smart card including all (demographic, unique Account ID and biometric) details is issued by the bank to the villager. This smart card is required to perform any transaction from their account with the bank.

BANK DATABASE ON SECURE WEBSITE AND CONNECTIVITY

Bank records information about authorized Agents and their respective blocks. Authorized agents are allowed to view only assigned blocks or villages. Bank also saves information about villager's demographic details and their biometric prints. Once a transaction is completed following information is stored about executed transaction; Unique Id of Agent and all demographic details of agent, Biometric and demographic details of villager from bank that contain information about current and balance after transaction by villager that confirms transaction.

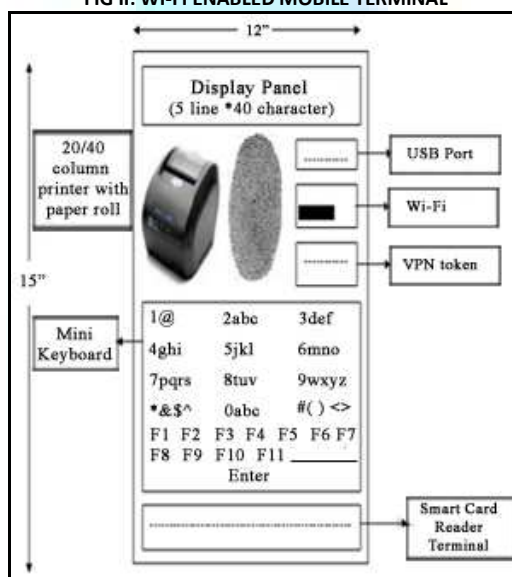
BLB MOBILE TERMINAL

EXISTING FEATURE

Every banking correspondent is provided with battery operated Wi-Fi enabled mobile terminal for authentication and connectivity with official bank website. It is usually a 12" X 15" inches set which has a display panel of 5 lines and 40 characters. A 20 column printer with a paper roll is placed on it to take transaction slip printout and a mini keyboard is attached with basic and some special purpose function keys to type in information. Every terminal has USB port to connect data travelers devices in which banking correspondent can download data or update transaction in case of internet connectivity to bank website is not working. A BioEnable Fingerprint Recognition Terminal (FRT) with LCD, fingerprint scanner is attached on MT. This device (FRT) also uses processor, memory, communication and data storage capabilities placed on Logic card of MT (The GreenBow 2011). A smart card reader terminal is positioned at bottom for reading smart card details of villagers (assigned by bank official) for their identification. It is sleekly designed with no cables or batteries and compatible with MT (Mobile Terminal). Smart Card uses SocketScan software and SDK saved on memory of Logic card.

A smart card is plastic card made-up with IC (Integrated Circuit) containing CPU, RAM, and non-volatile memory for storage and transaction of data (CardLogix Corporation, 2010). Application software and personal information of the AH and Account Number are saved in the chip at the time of issue of smart card to AH. It is secure portable device which is similar to a credit card in size and has storage capacity of 32MB. The card data is transacted via a reader that is placed on MT. Tamper proof storage of AH details greatly improves the convenience and security of bank transactions. Information saved in the microchip of this card can instantaneously verify the cardholder's identity through biometric properties, such as finger prints fed into MT using FRT.

FIG II: WI-FI ENABLED MOBILE TERMINAL



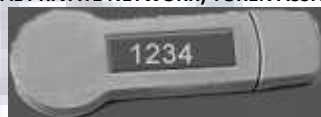
PROPOSED NEW FEATURE

USB socket is available for connecting VPN token given to BC by Bank for authentication of the correspondent.

VPN (VIRTUAL PRIVATE NETWORK) TOKEN

Tamper proof VPN Token is an authentication mechanism consists of a "token"—a piece of hardware and software. It is three way authentication device, where user should have **Login Details** (Username, Password and Group ID), and **VPN token** and must know **PIN** (Personnel Identification Number). It is plugged on the slot available on MT and protected with PIN + Random key, generated on the fly whenever token is inserted on device.

FIG III: VPN (VIRTUAL PRIVATE NETWORK) TOKEN ASSIGNED TO BLB AGENT



MODEL DESCRIPTION AND WORKING OF SYSTEM

PHASES

Implementation of proposed system is completed by practicing two phases:

- Preliminary Phase
- Operational Phase

PRELIMINARY PHASE

Multiple teams, authorized by Banks and State Govt. are allotted group of villages, may be 100 to 250 villages to one team. These teams, equipped with specialized Smart Card making equipment visit each village and on the basis of list of villagers provided to them by State Govt. Rural Development Department takes demographic data and thumb impression from each applicant, processes the information into database and issues Smart Card to them. The database is consolidated from all teams and submitted to the Bank and State Govt. During this phase, BLB agents are identified and asked to visit the nearest branch of the bank to get their identification verified, opening of BLB account, other formalities, issue of MT and VPN token.

OPERATIONAL PHASE

This phase explains the "Power On" process of MT by the following steps:

1. For execution of any transaction AH has to visit Agent with smart card.
2. In the beginning of any transaction, agent authorization is required for that purpose agent inserts VPN token on Mobile terminal slot and enter security PIN for login (3 way security procedure is explained in section V) and try to connect bank database or website.
3. Once Login is successfully completed he is allowed to view details of related block.
4. AH is also authenticated where smart card is inserted on MT and biometric details (finger, thumb impression, image or eye Retina) in card are matched with person holding the card.
5. If authentication procedure is successful then AH details can be accessed by agent. Account balance can be seen on the MT display.

TYPES OF TRANSACTIONS**WITHDRAWAL**

Agent enters the required amount on MT and waits for response from bank for withdrawal. The bank database checks status of AH balance and if the required amount is less than available amount, amount is withdrawn and give to AH by BLB agent. After completion of transaction a receipt is generated and signed by Agent and AH (Thumb impression of AH if he can't sign). Printed receipt contains information such as Transaction type: withdrawal, previous balance, amount withdrawn, new balance, date, time, AH name and Agent name. Original receipt is given to the AH and second copy is kept by agent for his record and third copy will be submitted in bank by agent.

DEPOSIT

Agent enters the amount to deposit on MT and waits for response from bank. AH gives the requested amount to the agent and agent deposits it to account of AH. Once the transaction is completed, receipt is generated and signed by Agent and AH (Thumb impression of AH if he can't sign). Printed receipt contains information such as Transaction type: deposit, previous balance, amount deposited, new balance, date, time, AH name and Agent name. Original receipt is given to the AH and second copy is kept by agent for his record and third copy will be submitted in bank by agent.

OTHER TRANSACTIONS

Disbursement under NREGS and other relief schemes of Central and State Govt. can also be processed through this framework.

SECURITY ASPECTS

Recognizing the mounted concern of rural e-banking security, we have considered security as a main concern in order to develop confidence of AH in anticipated new system. To assure security aspect it is required that these three parties authenticate themselves with each other. For all transactions, Bank, BLB Agent and AH have to ensure that they are dealing with each other without any imposter in between.

BLB AGENT AND BANK

1. Agent connects VPN on MT, security information stored on stick works only with the particular MT and if stick is lost, no one can use it on another computer, MT or any other device.
2. After plugging on to the slot, this three way security device will try and connect registered website or database.
3. On connection with website, BC has to enter uname, password and Block ID.
4. These details are verified from database and after due procedure of authentication a security string is available on the page where BC has to enter PIN + security string being displayed at that moment on his token.
5. On the other hand, the server which also has a real-time clock and a database of valid cards with the associated seed records computes what number the token is supposed to be showing at that moment in time, checks it against what the user entered, and makes the decision to allow or deny access.
6. On successful completion of authentication procedure, Agent is allowed to perform any transaction on database for AH.

VILLAGER/AH, BLB AGENT AND BANK

This is a three way security check:

1. First check is to compare the photo on smartcard with the person. Smart card has photo of card holder, so on single glance authentication can be checked whether person holding the card is authorized to use it or not.
2. Second check is comparison of biometric details. Smart card also saves biometric impression of AH, and same can be checked by swiping card on MT and giving thumb or finger impression on MT's FRT (Fingerprint Recognition Terminal).
3. Third check is to compare the card of AH with the list of lost cards maintained by bank website. This is done to avoid misuse of stolen cards.
4. At the time of registration smart card is issued to AH. Before committing any transaction AH is requested to verify his smart card consisting of his biometric details and if both are matched then transaction is completed otherwise it will stand cancel.

AGENT FAKING WITHDRAWAL

Agent can not initiate withdrawal without AH consent as smart card + biometric impression is required to access details of AH, and if it matches, only then transaction is completed at bank's end. Agent cannot afford to write incorrect amount for withdrawal, as withdrawal amount, current balance, balance after transaction is confirmed by bank through receipt generated by MT.

BLB MOBILE TERMINAL OR VPN TOKEN LOST

In case MT is lost, neither agent nor AH or any other person can misuse it because MT does not start without VPN token. Similarly, VPN token does not work without MT.

CONCLUSION AND FUTURE WORK

Our paper presents framework to implement branchless banking (BLB) in rural and remote areas. In this work, authors have attempted to address the issues raised in section 3 as follows:

- 1) Proposed framework will bring improvements in life of thousands of villagers, as they can access their bank accounts connected to main stream Bank like State Bank of Sikkim easily at their doorstep.
- 2) Here credibility is ensured as the smart card ID and thumb impression are verified before any transaction can be made. In addition, AH will receive printed slip of the transaction which also enhances credibility.
 - a) Through this framework Govt. can provide a secure environment where BLB agent and AH are duly authorized before executing any transaction. Also, all transactions are updated in main stream bank records on continuous basis. This will be helpful to avoid fraudulent transactions.
 - b) In this scenario BLB agent authentication is done through VPN token. It is three way authentication device, where user should have Login Details (Uname, Password and Group ID), VPN token and must know PIN (Personnel Identification Number).
- 3) Security aspects have been analyzed and criteria specified to enhance them in BLB framework in section 6.
- 4) Through this framework, main bank records will be updated simultaneously as and when any transaction is being done by AH. Only when network is temporarily down, previous days' data status will be utilized using backup in USB drives.
- 5) It is cost effective as it is using the existing IT infrastructure of banks and their portal evaluating online transaction. Further existing Telecom infrastructure is used for connectivity purpose which has almost country wide footprint.
- 6) It will be beneficial for Govt. as their new financial schemes can be extended to rural India using this BLB banking system and benefits will reach to concerned person without any middleman.

The usage of such schemes being initiated in some rural areas may be examined in future research.

In future eye retina can be used as biometric details in addition to finger and thumb impression for identification purpose. It is also possible to store critical health data on these smart cards and may be even provide health insurance to rural masses using this technological framework. Voice messages to/from over Wi-Fi network and required bandwidth can also be explored for authentication and transaction purposes in future work.

ABBREVIATIONS

AH- Account Holder, **BC**- Bank Correspondent, **MT**- Mobile Terminal, **BLB**- Branchless Banking, and **ATM**- Automated Teller Machine.

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