FPGA Based Design and Implementation of MicroATM

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Abstract— The major problem, faced by villages in India is the lack of ATMs. To overcome this problem, Micro-ATMs have been introduced. The Micro-ATM is used to access bank accounts in order to make cash transactions. This is a portable ATM that can help provide cash transactions to villagers.

In this paper the design of Micro-ATM is done using Verilog HDL that synthesizes cash withdrawals, deposits and balance enquiry. A card is required to access the Micro-ATM for further transactions.

The Micro-ATM serves one customer at a time. A customer will be required to enter the Card Number, Personal Identification number (PIN) - both of which will be sent to the database for validation as part of each transaction. The customer will then be able to perform one or more transactions. Also customer must be able to make a balance enquiry of any account linked to the card. If a transaction fails for any reason other than an invalid PIN, the Micro-ATM will display the error, and will then ask the customer whether he/she wants to do another transaction.

Keywords—Micro-ATM; Verilog HDL;

I. INTRODUCTION

The Micro-ATM device was originally described at a high level in a vision document by UIDAI titled "From Exclusion to Inclusion with Micropayments". It is meant to be a device that is used by a million Business Correspondents to deliver basic banking services at the last mile. A committee consisting of IBA, UIDAI, NPCI, IDRBT, RBI and various banks was created to define the specifications and use cases of this device, which are presented here. The costs of not standardizing a device like the Micro-ATM are quite high; large sections of Indian society will continue to be left out of the country's financial system. The telecom industry is widely regarded for relentlessly driving down costs and bringing coverage to large parts of the Indian population. Similar success is possible in the payments industry. The Micro-ATM is a first step towards providing an online, interoperable, low-cost payments platform to everyone in the country. The Micro-ATM device design and system architecture are influenced by the design of debit/credit card processing on Point-Of-Service (POS) terminals, combined authentication services that UIDAI will provide. The Micro-ATM is deployed by banks either directly, or through service providers. It is operated by individuals who are business correspondents themselves (individual BCs), or are sub-agents of a corporate BC. The Micro-ATM standards are broad-based, standards-based, and generic. They are based on a bank-led model for financial inclusion, where the UID infrastructure is an overlay on the existing banking infrastructure.

The basic transaction types that the micro-ATM will support are:

i) Deposit
ii) Withdrawal
iii) Funds transfer
iv) Balance enquiry and mini-statement

The objectives of these specifications are to:

i) Bring down transaction costs
ii) Ensure interoperability
iii) Ensure security and transparency of transactions
iv) Bring down the cost by being compatible with existing systems
v) Provide a uniform customer experience
vi) Reduce agent training needs

This project describes the following, to achieve the stated objectives:

i) High-level system architecture for micro-ATM transactions
ii) Roles of various participants
iii) Supported transaction types
iv) Functional requirements for micro-ATMs
v) Minimal hardware requirements
vi) Interoperability

II. LITERATURE SURVEY

According to World Back, roughly 2 billion people around the world do not have access to formal sources of banking and financial services, or more than 50% of small and medium-sized businesses worldwide lack adequate access to credit. However, financial services to poor and rural people have many limitations including lack of security and high operation costs. As a result microfinance was developed as a cost effective and sustainable way of expanding outreach of the banking system to the rural area with the goal of setting financial inclusion and equality. One effective tool to reach deeply into rural areas is micro-ATM. Micro-ATMs which is similar to a POS (Point Of Sales) has its functions like a normal ATM such as: cash withdrawal, cash deposit, balance enquires and other functions based on each Microfinance Institutions. It has now become a national priority to rapidly accelerate progress toward financial inclusion and ensure safe, secure, sound, efficient access to basic financial services for all residents. Towards this end, a UID-enabled micropayments system is being conceived, which will be based on networks of agents managed by banks.

It has now become a national priority to rapidly accelerate progress toward financial inclusion and ensure safe, secure, sound, efficient access to basic financial services for all residents. Towards this end, a UID-enabled micropayments system is being conceived, which will be based on networks of agents managed by banks. These agents will perform financial transactions using Micro-ATMs. A variety of financial services can be offered once a UID-enabled micropayments platform is available throughout the country. Several last mile collection problems can be solved with

the micropayment device; for example, interest payments for micro-finance loans, premiums for micro-insurance policies, contributions to micro pensions accounts, investments in micro-mutual funds. Likewise, payouts can be made through the same infrastructure as well.

A. *Motivation*

One of the effective tools to reach deeply into rural areas is Micro-ATM. Micro-ATMS which is similar to point of sales has its functions like a normal ATM such as: cash withdrawal**,** cash deposit, balance enquiries and other functions based on each Microfinance Institutions. It provides many benefits such as: ease of payments at doorstep instead of traveling along distances, minimized queuing leading to operational efficiencies at Banks, accurate and fast transaction, eliminating middlemen, etc. However, one of the problems restricting the growth of micro ATMS is the security vulnerability or in other words, how can the machine recognize it's the right person to allow the transaction.

B. *Benefits of the technology*

OTPs are used because there are invulnerable to the drawbacks of static passwords where a hacker can make use of password to access the account. This is of high significance in a rural setting where the users might not be tech savvy to understand the importance of keeping a password secure. The OTP generated is shared with the BC agent and entered through the mobile device. Next, the OTP validation request is sent to UPASS backend server. After successful validation, the amount to be withdrawn is entered through the mobile device, and the mapping and validation are done at the UPASS backend server. Finally, a transaction receipt command is sent to the mobile device. The receipt is printed through the thermal printer, and the cash as well as transaction receipt are handed over to the customer. The transaction is concluded with a confirmation SMS sent to the customer, and End of Day data is shared by the BC with the bank for the customer's account updation.

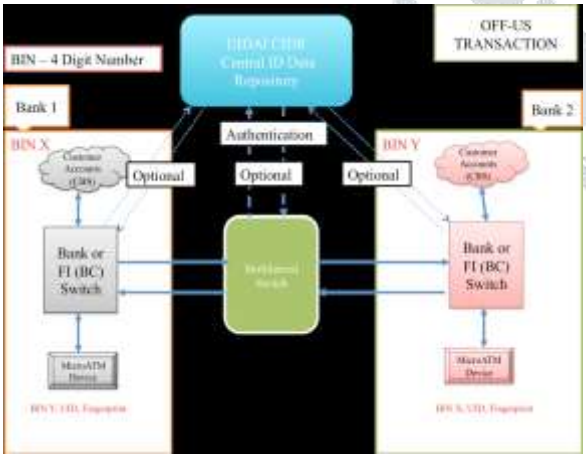

Fig. 1: Process flow of Micro ATM for transactions

III. Design and Algorithm

A. *Design*

The generic process flows for how withdrawal, deposit, funds transfer, and balance enquiry transactions must be conducted by micro-ATMs, are described below. The operator must log in using either PIN or biometric authentication (if s/he is not already) before conducting any transaction. These flows do not include the activity on the network or the backend.

B. *Withdrawal*

i) Operator enters customer BIN+UID and transaction amount. (Micro-ATM may allow customer UID number to be automatically read from a card via a device such as a card reader or barcode scanner but manual entry of customer BIN+UID number by operator must also be supported).

ii) Device displays and provides voice summary of transaction details and prompts for confirmation.

iii) Customer indicates confirmation by supplying fingerprint.

iv) Success or failure of transaction is displayed on Micro-ATM screen.

v) (Device may also notify operator and customer of the success or failure of transaction through other methods such as voice message or SMS but display and paper receipt is required).

vi) If transaction has been successfully processed, operator dispenses cash.

vii) Customer's account is debited, and the operator's account is credited.

viii) Receipt is printed and handed over to the customer.

C. *Desposit*

i) Customer hands over cash to operator.

ii) Operator enters the customer BIN+UID and transaction amount. (Micro-ATM may allow customer BIN+UID number to be automatically read from a card via a device such as a card reader or barcode scanner but manual entry of customer UID number by operator must also be supported).

iii) Device displays and provides voice summary of transaction details and prompts for confirmation.

iv) Customer indicates confirmation by supplying fingerprint.

v) Success or failure of transaction is displayed on Micro-ATM screen. (Device may also notify operator and customer of the success or failure of transaction through other methods such as voice message or SMS).

vi) In case of rejection, operator returns cash to customer.

vii) In case of success, customer account is credited, and the operator's account is debited.

viii) Receipt is printed and handed over to the customer.

D. *Funds Transfer*

i) Operator enters customer BIN+UID, recipient identifier (BIN+UID, IFSC + Account number, or BIN + mobile number), and transaction amount. (Micro-ATM may allow customer BIN+UID number to be automatically read from a card via a device such as a card reader or barcode scanner but manual entry of customer UID number by operator must also be supported.)

ii) Device displays and provides voice summary of transaction details and prompts for confirmation.

iii) Customer indicates confirmation by supplying fingerprint.

iv) Success or failure of transaction is displayed on Micro-ATM screen. (Device may also notify operator, customer, and recipient of the success or failure of transaction through other methods such as voice message or SMS).

v) In case of success, customer account is debited, operator account is credited with the commission, and the recipient account is credited with the rest of the amount.

E. Balance Enquiry

i) Operator enters the customer BIN+UID. (Micro-ATM may allow customer BIN+UID number to be automatically read from a card via a device such as a card reader or barcode scanner but manual entry of customer BIN+UID number by operator must also be supported).

ii) Device displays and/or provides voice indication that customer seeks to perform a balance enquiry.

iii) Customer indicates confirmation by supplying fingerprint.

iv) Balance printed on paper receipt only. The printout should include the last ten transactions. (In the case of balance enquiries, Micro-ATM should not send information regarding customer balance via other methods such as voice message or SMS).

IV. RESULTS

The Micro-ATM controller has been designed. The figures shown below depict various outputs simulated from the designed code. An overall circuit map of the controller is displayed below. It shows all the circuit connections of the Micro-ATM controller.

This chapter provides various results for the Micro-ATM controller. The first are the simulation results that depict the changes in the various variables of the controller showing the overall output.

1) INVALID CARD

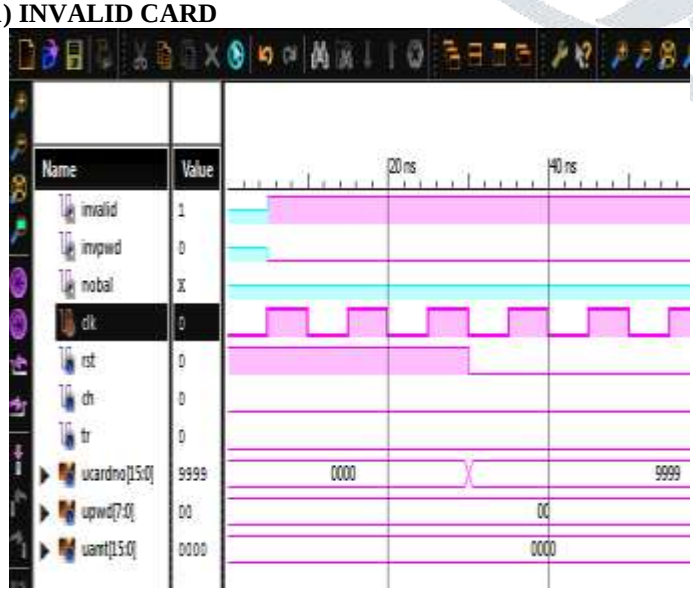

Fig. 4.1: Invalid Card

2) VALID CARD

Fig. 4.2: Valid Card

3) INVALID PASSWORD

Fig. 4.3: Invalid Password

4) INVALID AMOUNT

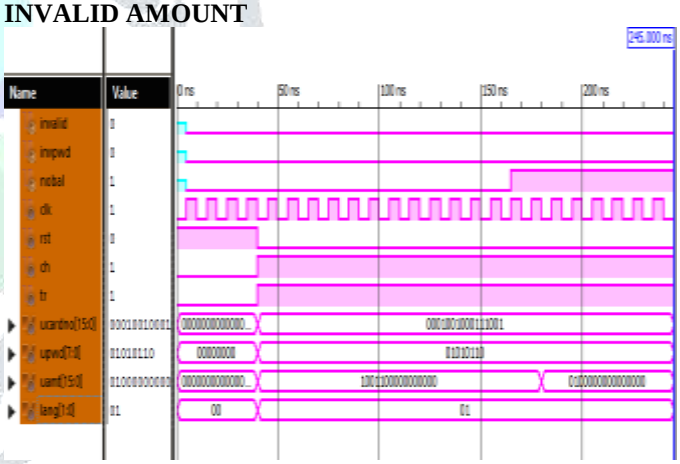

Fig. 4.4: Invalid Amount

5) RTL SCHEMATIC

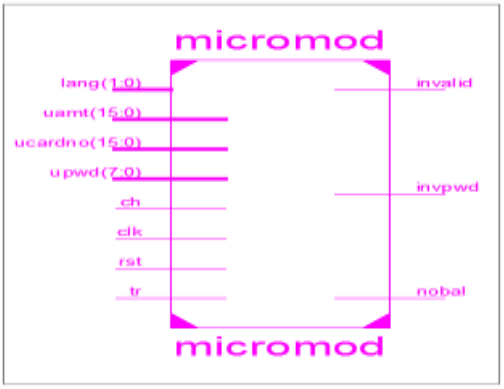

Fig. 4.5: RTL Schematic

V. CONCLUSION

Micro-ATMs are the latest electronic field that has contributed to the welfare of the society. Due to their small size, cheap costs and drastically lower maintenance compared to an ATM they are bound to become pillar for the future society. This device will be deployed by Business Correspondents to implement branch-less banking; provide banking services where bank branches are not present. The Micro-ATM standards only provide for basic banking transactions: deposit, withdrawal, funds transfer, and balance query. The Micro-ATM functionality has been restricted to a small set of transactions, so that the device can be robust and simple, but can be scaled for ubiquitous country-wide deployment. Interoperability is a key feature of the Micro-ATM, where customers can visit any country and operate their account.

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