

## A SOLAR POWERED, BIOMETRIC BASED ATM FOR THE RURAL MASSES OF INDIA: 'BIO-SOLAR ATM'

Prof (Dr.) SP Gonchaudhuri

Richik GhoshThakur

Avijeet Dutta

### ABSTRACT

Rural Populace, who constitute the major part of India's Population, have always been the sufferers on the advent of new technology in the field of banking which makes it easier for most of the urban populace but worsens it for the rural people. They are helpless as most of them are basically unlettered and withdraw money from banks using their thumb signatures. They are unable to use ATM machines which work by the use of a card and 4 digits PIN but they are in desperate need of an ATM which is compatible with their level of understanding. In times like these where we are approaching fast towards a complete digital & cashless economy, this is an urgent requirement. Thus a prototype of the biometric based 'BS-ATM' is designed which is User friendly (Based on A/V touch interface) and at the same time avoids the use of cards, PIN and paper. This ATM is also energy efficient and environment friendly as it involves the use of solar energy to power it. In addition to this, various security measures have been implemented using unique logical approaches, keeping provisions for future developments. Banks are not interested to keep ATM machines in villages due to absence of power and irregular availability of electricity.

### 1. INTRODUCTION

According to the 2011 census, the average literacy rate in India is 74.04%, where the male literacy rate is 82.14% and the female literacy rate is 65.46%. This gives us a rough estimate of 17.36cr female unlettered and 9.65 Cr male unlettered in our country. With the maximum of the Indian population now holding a bank account due to the implementation of several programs and schemes of our government, people falling into the rural unlettered category find it difficult to obtain fast cash for their daily or urgent needs. They cannot use conventional ATMs because of the requirement of a certain level of literacy to operate these machines. On the other hand going to the banks for small transactions are cumbersome for them because of huge attendance in banks. To tackle this situation, 'BS ATM' is presented which will solve the problem at hand.

Keeping in mind the increasing literacy programs run by our government like 'National Literacy Mission Program', 'Sarva Siksha Abhiyan', etc to ensure primary education to every individual, India's literacy rate increased only sluggishly AT 1.5% per year. According to a 1990 study, it was

estimated that India will take 46 more years to achieve global literacy rate. With new schemes we are looking at approximately 20 yrs more to achieve global literacy rate, thus it will be highly beneficial and cost effective measure. This machine will also have lower manufacturing costs than conventional ATM machines. States like Punjab, Bihar, UP, West Bengal, Delhi and 16 other states have literacy rates alarmingly low where the ATM could be implemented. It will also solve the issue of the suffering unlettered women class who are working in urban households as housemaids. A Study on them revealed that though the housemaids earn money, they are solely dependent on their husbands for banking and transactional purposes. The current scenario is that these husbands flee with the money leaving these housemaids at distress, thus implementation of the machine will make them self sufficient in terms of banking thus making it a major asset towards women empowerment.

### 1.1 Present scenario of ATMs in India:

There are presently **2, 05,151** ATM machines in the country.

#### ATM technologies in India:

- Conventional ATM (card+pin): Most of the machines.
- Biometric ATM (card +biometrics): Bioenable Pvt. Ltd.
- Conventional solar ATM : Vortex Engg. Pvt. Ltd.
- Biometric + Adhaar no.: Indian bank, Union Bank : 'Kisan ATM', Dena Bank, Corporation Bank: 'Talking ATM')

#### Some information about conventional ATMs:

- The Average manufacturing cost of an ATM is about 6 Lakhs (8.6k USD) on an average.
- Average Manufacturing cost of an ATM card: Rs 10/-
- An average ATM card contains about 5gms of plastic.
- Average daily power consumption of an ATM is 5.52kWh
- No power saving/ Standby mode for ATMs.

#### There is no ATM in India which works on Solar PV, Biometrics and A/V Interaction combined.

## 2. AIMS AND OBJECTIVE

#### The 'BS ATM' aims at achieving the following:

- **User Friendliness:** anybody can use the 'BS-ATM' as it is operated only on biometrics and touch based interactive audio visual interfacing which uses biometric identification to identify individuals and Audio-Visual interface to guide and complete the transaction. It is designed to be operated by both the unlettered masses and those who fail to use conventional ATMs.
- **Environment Friendliness:** This ATM is a Green device which will be operated on solar PV power and have card-less (plastic less) and paperless operation as the user is his/her own ATM card. Use of biometrics

rests the use of ATM cards. At the end of every transaction, the users will be notified about their remaining balance through audio thus avoiding the use of paper receipts.

- **Very Low Running Cost:** Unlike conventional ATM machines, this machine will run in DC on Solar PV supply in both standalone and Grid connected mode, thus reducing the operating cost greatly. It uses energy efficient framework and components which reduces the power consumption of the machine at 300W peak consumption and 50W standby mode consumption.
- **Fast and Secure:** The main issues with conventional ATM are loss of ATM cards and lack in memorizing the PIN number, added to that both the card and the PIN can be misused by anyone and is often stolen. This behavioral authentication procedure is replaced by 2 stage biometric fingerprint scan and authentication procedures which are both physiological and more secure in nature, leading to faster transactions.
- **Adhaar Linkage:** The bank accounts of the users will be linked with their adhaar card by which users will be identified using biometrics. The biometric information obtained from adhaar enrollment will be used for the transaction procedure.

## 3. METHODOLOGY

The Simple working principle of this ATM will ensure that manufacturing and technical problems are minimized.

It uses the following main components:

- MICRO CONTROLLERS
- MICRO PROCESSOR
- PV MODULE
- POWER SUPPLY MODULE
- FINGERPRINT MODULE
- DISPLAY MODULE
- SPEAKER, HEADPHONE
- BANK LOCKER, CASH DISPENSER
- EEPROM, SERVERLINK, OTHER INPUT

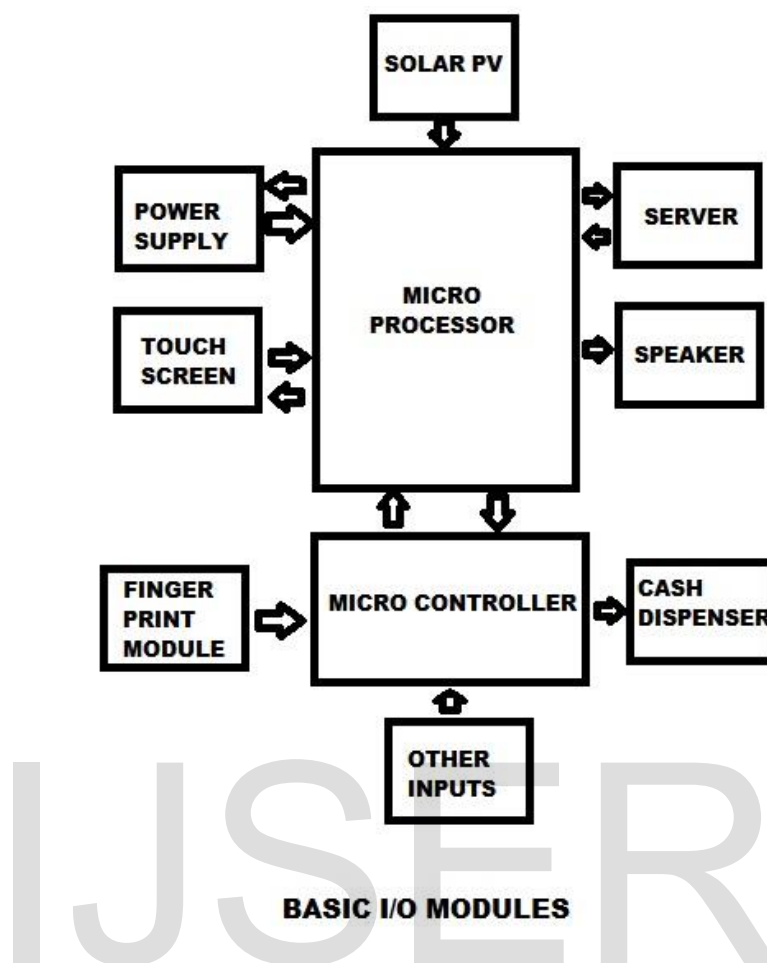


Figure 1: Block Diagram showing basic I/O modules

### 3.1 Operating Principal and Logic:

1. The user enters the ATM terminal; the proximity/PIR sensors are activated.
2. The Standby mode is turned off and the ATM Notifies the user to scan his/her fingerprint(s) by an audio & video instruction on what to do next in local language.
3. After the fingerprint is scanned, The ATM finds a possible match to any registered user.
4. The ATM asks the user to show the QR code of his/her aadhaar card.
4. If match is found the ATM displays the details of the user on the screen pictorially and will guide the user to the amount selecting screen where 100,200 and 500 rupee notes are displayed on the screen.

5. The user presses which note or combination of notes he/she wants to withdraw. The maximum amount a user can withdraw at a single time is Rs.2000. This is done keeping in mind the average requirement of money by any rural customer. If a user wants to withdraw Rs.2000 then he/she presses the 2000 note symbol and if the amount is available in the ATM, the denomination of the note is dispensed, which is also instructed by audio. Only the available notes will be shown on the touch screen. The Limit of transaction will also be notified.
6. By entering the denomination, the user confirms the transaction. On cancellation of the transaction anytime, the user just has to press the Cross Button.
7. If all processes are done correctly cash is dispensed from the machine. If the user has lower

balance than the withdrawal request then the users will be notified about the remaining amount by an audio through headphones (also instructed via A/V) to maintain secrecy.

### 3.2 Implemented Logic:

The following logic components are used in the ATM:

1. **Microprocessor:** An Intel quad core 64 bit Micro Processor is the main brain of the system. The Processor is integrated with a motherboard with 2Gigabytes of RAM and 500GB Hard drive running dual windows & Linux operating system where the main programming has been done. It is

If any process is incorrect or any input is invalid then the process will repeat from the last correctly done step.

interfaced with multiple microcontrollers, PLCs one in charge of operating the cash dispenser and another for operating the fingerprint module, the server link, Power supply Module, Screen and Speaker/Headphone as shown in Figure 1 above. The microprocessor has a greater processing capability thus it will be responsible for data exchange with these components.



Figure 2 : Image showing Microprocessor at the right and microcontrollers at the left

2. **Microcontroller:** There are two ATMEGA 328L microcontrollers involved. One handles the data input from RS-305 fingerprint module and another operates the Cash Dispenser module. The microcontroller system is arduino mega connected to the PC via the Serial ATA. This is shown in the above picture on the left side.



Figure 3: Mantra MFS-100 Fingerprint Sensor

3. **Fingerprint Sensor:** The Mantra MFS-100 fingerprint sensor can interface with the microcontroller via Rx/Tx which is both easier and efficient than PC interfacing. Interfacing with the PC leads to security loopholes which can be exploited instead the module is interfaced with the PLC which is connected to the PC.

4. **Power Supply Module:** The Power supply module has a built in demand controller which manages power input from the Grid and Solar PV. It takes the majority of power from the SPV module and the rest from the Grid.

This system is based on the following Logic Flowchart:

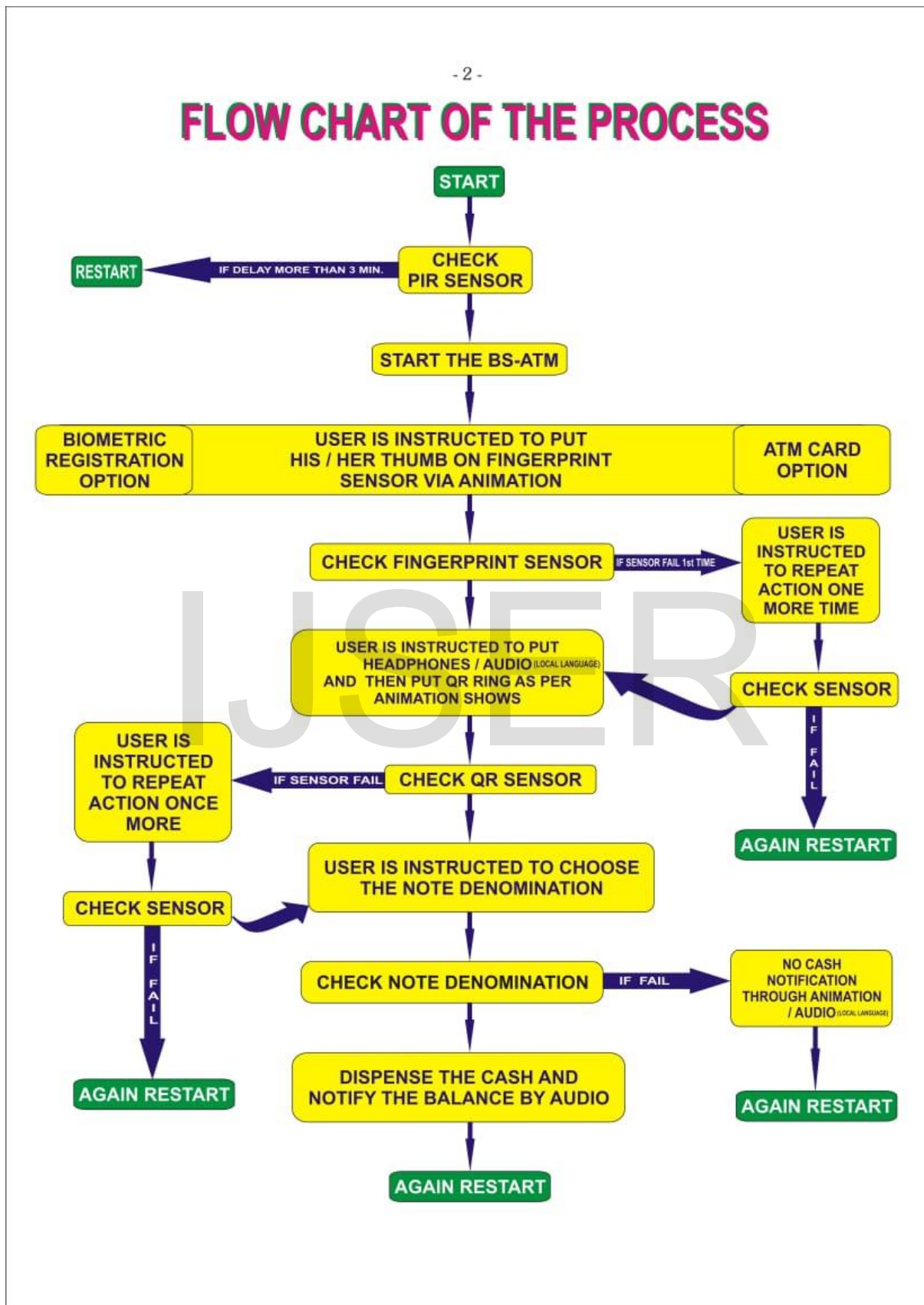


Figure 2: Flowchart of the Logic process

### Withdrawal of cash from the user's perspective:

1. Enter the 'JANATA ATM' terminal
2. Scan the Fingerprint
3. Scan QR code of Aadhaar card
4. Listen to balance
5. Select the amount
7. Listen to updated balance via headphone.
8. Take dispensed cash

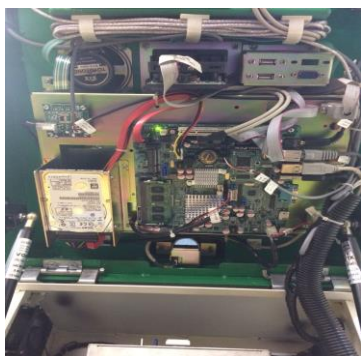


Fig: Internal System

### Some other Unique features of the 'JANATA ATM':

- **Language Adaptation:** The ATM's language preference will be set according to the user's local language as obtained from the user's Aadhaar card.
- **Joint Account Holders:** In case of users holding joint accounts, biometrics of two users will be taken or one user can act as the operator of the account.
- **Updated Via Network:** Issues such as Demonetization can lead to failure in the ATM's operation but this ATM can be calibrated wirelessly through its network for Updating and Calibration. The new notes have to be physically deposited in the dispenser.



### 4. CONCLUSION:

Thus 'JANATA ATM' which abides by the green Energy initiative, is the answer to all critical problems we face today. It is an approach to make the environment cleaner and greener at the same time empowering the women class and the Rural Unlettered sections as well. Its minimalistic design will add to the ease in manufacture and maintenance.

### 5. REFERENCES:

1. *Census #India*. 'Census of India'. Retrieved 2011-03-31
2. National Sample Survey Organization (NSO), 2016
3. Population Institute, East West Centre, Dec 1990
4. Robert Engelman; et al. (2009). "The State of World Population 2009"
5. *India Real Time*, WSJ India
6. RBI, <https://rbi.org.in/scripts/atmview.aspx>
7. "RuPay card Launch". NPCI. March 2011.
8. IBEF, <http://www.ibef.org>

IJSER