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Advanced Microcontroller Based Bio-Metric Authentication Voting Machine

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Abstract: **-** Biometric voting has made the voting procedure simpler. It is a revolutionary method preferred to traditional EVM voting as it is risk defective. It is advantageous because it includes features such as voters can able to caste their votes globally, reduction of counting time , expenditure incurred on man power deployment and carrying of photo id cards for recognition. Stored finger prints are retained even in the event of complete power failure or battery drain. He/she grants permission to the voters to vote their selected candidates if the finger print are recognized. Each person can vote for one candidate only. Finally results are being displayed , when the polling officer enters the password.

Keywords: **-** *Arduino microcontroller, ATmega328,FingerPrintmodule , Visual basics*

I. INTRODUCTION

Electronic Voting Machines ("EVM") are being used in Indian General and State Elections to implement electronic voting in part from 1999 elections and in total since 2002 elections. The EVMs reduce the time in both casting a vote and declaring the results compared to the old paper ballot system. The EVMs were devised and designed by Election Commission of India in collaboration with two Public Sector undertakings viz., Bharat Electronics Limited, Bangalore and Electronics Corporation of India Limited, Hyderabad. The EVMs are now manufactured by the above two undertakings. EVMs were first used in 1982 in the by-election to Parur Assembly Constituency of Kerala for a limited number of polling stations (50 polling stations.

Voting is the bridge between the governed and government. The last few years have brought a renew focus onto the technology used in the voting process and a hunt for voting machines. Computerized voting systems bring improved usability and cost benefits but suffer from weak software which has lot of bugs. When scrutinized, current voting systems have security holes and it becomes difficult to prove even simple security properties about them. A voting system that can be proven correct would solve many problems. High security is essential to elections. There has been a lot of attention to an electronic voting by cryptographers. Many scientific researches have been done in order to achieve security, privacy and correctness in electronic voting systems by improving cryptographic protocols of e-voting systems. Currently, the practical security in e-voting systems is more important than the use of cryptographic schemes .One of the main interests is seemingly contradicting security properties. On one hand, voting must be private and the votes should be anonymous. On the other hand, voters must be identified in order to guarantee that only the eligible voters are capable to vote. Hence, e-voting should be uniform, confidential, secure and verifiable. The most important requirements for e-voting can be characterized as:

- Eligible voter is authenticated by his/her unique characteristics.
- Eligible voters are not allowed to cast more than one vote.
- Votes are secret.
- Auditors can check whether all correct cast ballot participated in the computation of the final tally.
- Result of election should be secret until the end Of an election.
- While voting is on, there should not be a method of knowing intermediate result that can affect the remaining voter's decisions
- All valid votes must be counted correctly and the system outputs the final tally.
- It must be possible to repeat the computation of the final tally.

The following three dimensions are used to make a comparison of electronic voting systems for various nations

- Whether a country's system uses a paper audit trail.
- Whether the system permits an anonymous, blank or spoiled ballot.
- Whether the software is open source or proprietary.

We have proposed a model for e-voting based on biometric technique. Biometrics has been widely used in various applications such as criminal identification, prison security electronic banking, ecommerce .Biometric authentication requires comparing a registered or enrolled biometric sample (biometric template or identifier) against a newly captured biometric sample (for example, a fingerprint captured during a login). During enrollment , a sample of the biometric trait is captured, processed by a computer and stored for later comparison. Biometric recognition can be used in identification mode, where the biometric system identifies a person from the entire enrolled population by searching a database for a match based solely on the biometric. A system can also be used in verification mode, where the biometric system authenticates a person's claimed identity from their previously enrolled pattern. This is also called "one-to one" matching . The proposed model uses biometrics in the verification mode during e-voting. we can conclude that the finger print recognition is that fast and accurate biometric technique required for making reliable and secure system .

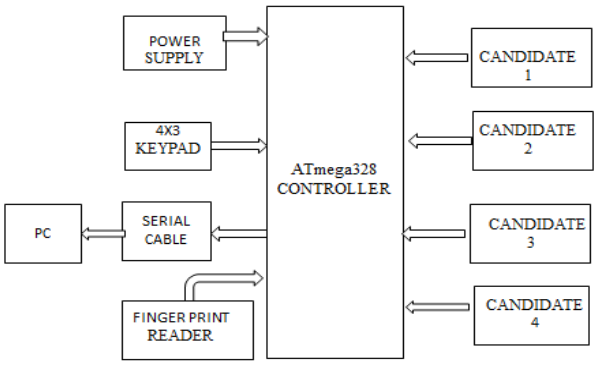

Fig.1. Block diagram

I. ARDUINO MICROCONTROLLER

The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins(of which 6 can be used as PWM outputs),6 analog inputs, a 16MHZ crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller. It can be simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all precedings boards in that it does not use the FTDI USB-to-serial driver chip. Instead , it features the Atmega8U2 programmed as a USB-to-serial convertor.

1.1 FEATURES:

Microcontroller	ATmega328
Operating voltage	5V
Input voltage(recommended)	7-12V
Input voltage(limits)	6-20V
Digital I/O pins	14(of which 6 provide PWM output)
Analog input pins	6
DC current per I/O pin	40mA
DC current for 3.3v pin	50mA
Flash memory	32 KB (ATmega328) of which 0.5 KB used by bootloader
SRAM	2 KB(ATmega328)
EEPROM	1 KB (ATmega328)

II. ATMEGA328

The ATmega328P is a low power CMOS 8-bit microcontroller based on AVR enhanced RISC architecture. By executing powerful instructions in a single clock cycle, ATmega328P achieves throughputs approaching 1 MIPS per MHZ allowing the system designer to optimize power consumption versus processing speed.

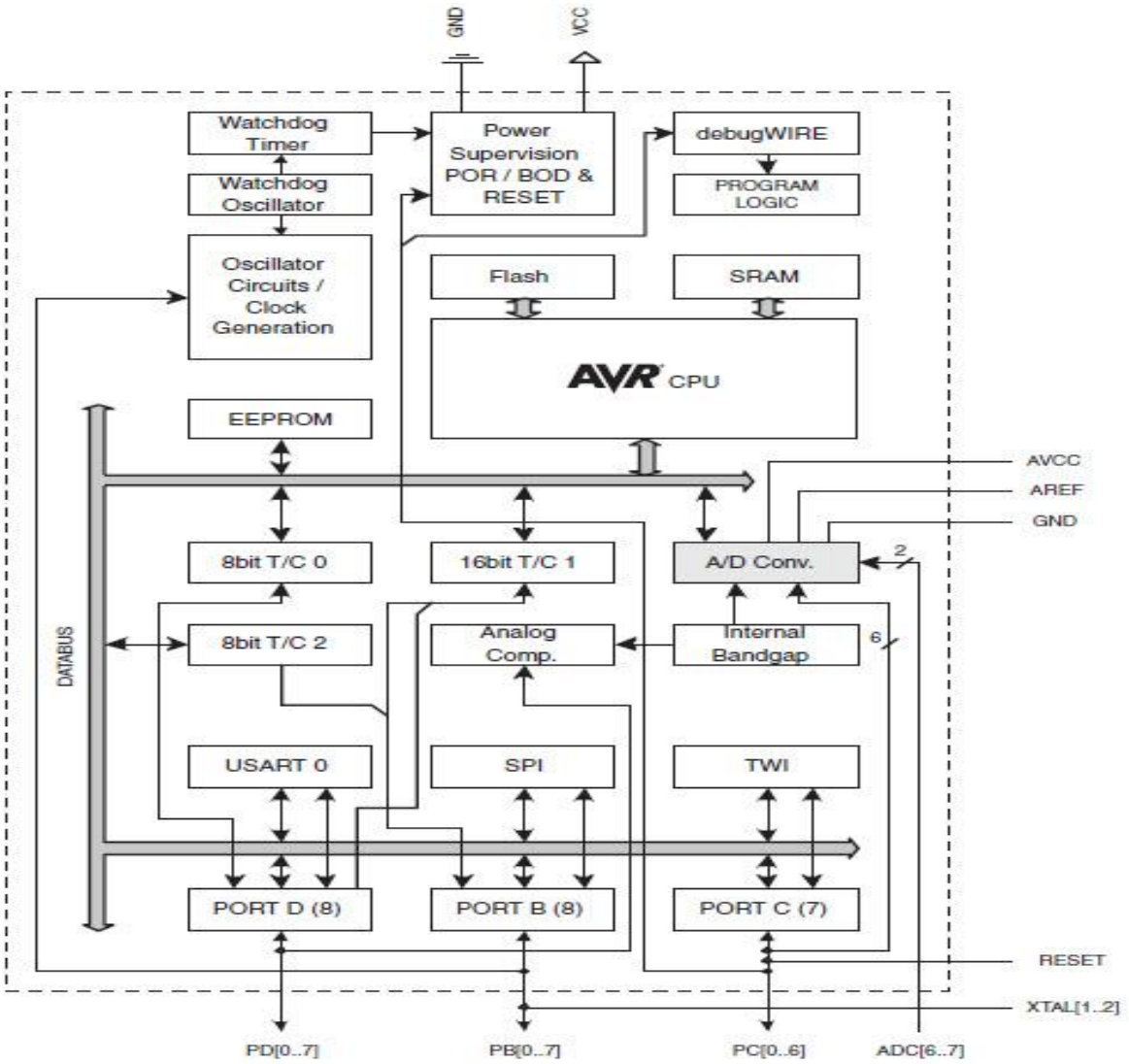

Fig.2. Architecture of ATmega328

1.2 FEATURES

- High performance
- Advanced RISC architecture
- ➢ Most single clock cycle execution.
- ➢ Up to 20 MIPS throughput at 20MHZ.
- High endurance non volatile memory segments

1.3 PERIPHERAL FEATURES

- Two 8-bit timer/counters with separate prescalar and compare mode
- Real time counter with separate oscillator
- Programmable serial USART.
- Master slave SPI serial interface
- On-chip analog comparator

1.4 SPECIAL MICROCONTROLLER FEATURES

- External and internal interrupt sources.
- Six sleep modes: idle,ADC noise reduction, power-save ,standby and extended standby.
- I/O and packages : 23 programmable I/O lines
- Operating voltage :1.8-5.5v
- Speed grade: 0=20 Hz
- Low power consumption at 1 MHz
- Active mode : 0.2 ma
- Power down mode : 0.1µA
- Power save mode : 0.75µA

PIN DIAGRAM:

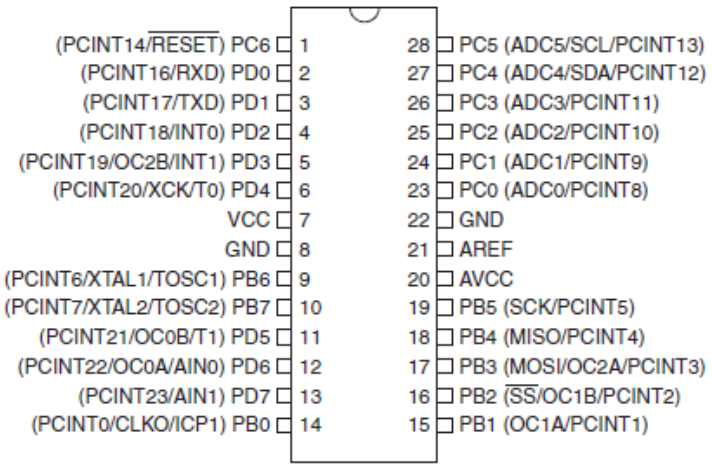

Fig.3 Pin diagram of ATmega328

1.5 PIN DESCRIPTIONS

VCC:Digital supply voltage

GND: ground

PORT B (PB7:0):

Port B is an 8-bit bi-directional I/O port with internal pullup resistors (selected for each bit). The port B output buffers have symmetrical drive characteristics with both high sink and source capability. As inputs, port B pins that are externally pulled low source current if the pull-up resistors are activated. The port B pins are tri-stated when a reset condition becomes active, even if the clock is not running.

PORT C (PC5:0):

Port C is a 7 bit bi-directional I/O ports with internal pull-up resistors. The PC5:0 output buffers have symmetrical drive characteristics with both high sink and source capability as inputs, port C pins that are externally pulled low will source current if the pull-up resistors are activated. The port C pins are tri-stated when a reset condition becomes active , even if the clock is not running.

PC6/RESET:

If the RSTDISBL fuse is programmed, PC6 is used as an I/O pin. The electrical characteristics of PC6 differ from those of the other pins of port.

If the RSTDISBL fuse is unprogrammed, PC6 is used as a reset input. A low level on this pin for longer than minimum pulse length will generate a reset, even if the clock is not running.

PORT D(PD7:0):

Port D is an 8-bit bi-directional I/O port with internal pull-up resistors.

AVCC:

AVCC is the supply voltage pin for the A/D Converter, PC3:0, and ADC7:6. It should be externally connected to VCC, even if the ADC is not used. If the ADC is used, it should be connected to VCC through a low-pass filter. Note that PC6..4 use digital supply voltage, VCC.

AREF:

AREF is the analog reference pin for the A/D Converter.

ADC7:6 (TQFP and QFN/MLF Package Only)

In the TQFP and QFN/MLF package, ADC7:6 serve as analog inputs to the A/D converter. These pins are powered from the analog supply and serve as 10-bit ADC

1.6 POWER SUPPLY UNIT:

Power supply is a very important part of electronic circuit this circuit required fixed +5 V supply so to fix this voltage we needed voltage regulator. In this work used 7805 Voltage regulator which output fixed +5 volt. A voltage regulator generates a fixed output voltage of a preset magnitude that remains constant regardless of changesto its input voltage or load conditions .we are using a step down transformer to providing a necessary supply for the electronic circuits thereby voltage is step down from 230v ac into 12v ac.

CIRCUIT DIAGRAM

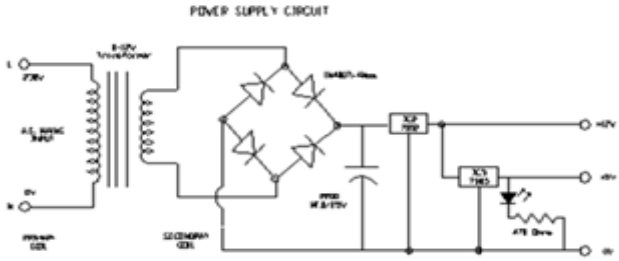

Fig .4.Circuit diagram of power supply

III. FINGERPRINT MODULE

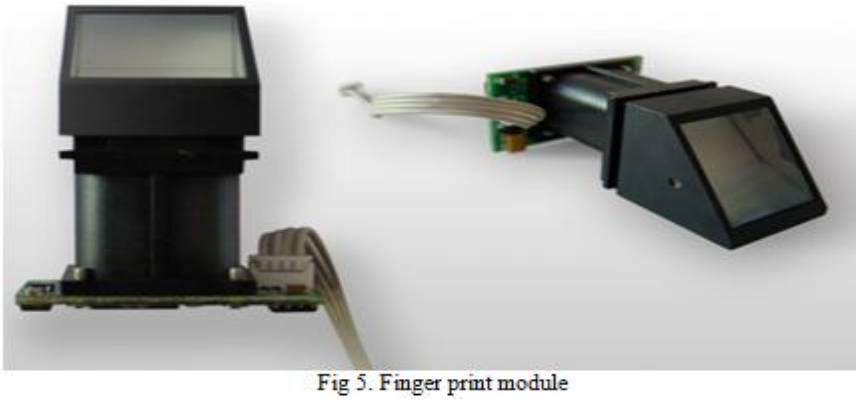

Fig 5. Finger print module

1.7 OPERATING PRINCIPLE:

Finger print processing includes 2 parts

- Finger print enrollment
  When enrolling, user needs to enter the finger two times. The system will process the two time finger images, generate a template of the finger based on processing results and store the template.
- Finger print matching (1:1 or 1:N)
  When matching, user enters the finger through optical sensor and system will generate a template of the finger and compare it with templates of the finger library.

TABLE 1.SPECIFICATION

Power	DC 3.6V-6.0V	**Interface**	UART(TTL logic level)/ USB 1.1
Working current	Typical: 1 00mA Peak: 150mA	**Matching Mode**	1:1 and 1 :N
Baud rate	(9600*N)bps,	**Character file size** N = 1 1 2 (default	256 bytes N=6
Image acquiring time	<0.5s	**Template size**	512 bytes
Storage capacity	256	**Security level**	5 (1, 2, 3, 4, 5(highest))
FAR	<0.001%	**FRR**	<0.1%
Average searching time	< 1s (1:1000)	**Window dimension**	1 8mm*22mm
Working environment	Temp: -10- +40	**Storage environment**	Temp: -40 to +85
	RH: 40%-85%		RH: <85%
Outline Dimention	Split type	Module: 32*23*7mm Sensor:56*20*21 .5mm	
	Integral type	54.5*20.6*23.8mm	

1.8 BUFFER

There are an image buffer and two 512-byte-character-file buffer within the RAM space of the module.
Image buffer:
Image Buffer serves for image storage and the image format is 256*288 pixels.
Character file buffer :
Character file buffer, CharBuffer1, CharBuffer2, can be used to store both character file and template file.

IV. VISUAL BASICS

Visual Basic is a third-generation event-driven programming language . Microsoft intends Visual Basic to be relatively easy to learn and use. Visual Basic was derived from BASIC and enables the rapid application development (RAD) of graphical user interface (GUI) applications, access to databases using Data Access Objects.A programmer can create an application using the components provided by the Visual Basic program itself.

1.9ADVANTAGES:

- VB is used as a front end tool.
- It is easy for hardware interfacing.
- It has user friendly environment.
- It provides graphical user interface

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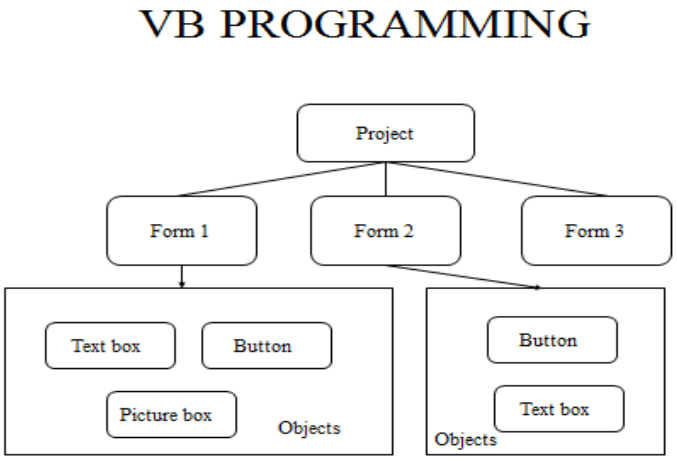


Fig. 7 Visual basics

V. DATA PACKAGE FORMAT

When communicating, the transferring and receiving of command/data/result are all wrapped in data package format.

TABLE 2. DATA PACKAGE FORMAT

Header	Adder	Package identifier	Package Length	Package content (instruction/data/Parameter	Checksum

TABLE 3.COMMAND PACKAGE FORMAT

2 bytes	4bytes	1 byte	2 bytes	1 byte	1 byte	2 bytes
Header	Module Address	Package identifier	Package Length	Instruction Code	Buffer number	Checksum
0xEF01	Xxxx	01H	04H	02H	BufferID	sum

VI. TO GENERATE TEMPLATE

Description: To combine information of character files from CharBuffer1 and CharBuffer2 and generate a template which is stored back in both CharBuffer1 and CharBuffer2. Input Parameter
Return Parameter
Instruction code: 05h

TABLE4.COMMAND PACKAGE FORMAT

Header	Module Address	Package identifier	Package length	Instruction Code	Checksum
0xEF01	Xxxx	01H	03H	05H	09H

TABLE5.ACKNOWLEDGE PACKAGE FORMAT

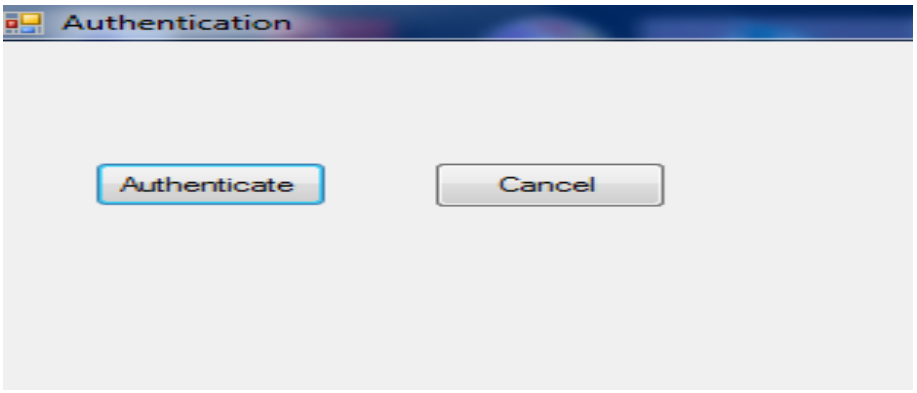
2 bytes	4bytes	1 byte	2 bytes	1 byte	2 bytes
Header	Module Address	Package Identifier	Package length	Confirmation Code	Checksum
0xEF01	Xxxx	07H	03H	XxH	sum

Note: Confirmation code=00H: operation success;
Confirmation code=01H: error when receiving package;
Confirmationcode=0aH:fail to combine the character files. That'sthe character files don't belong to one finger.

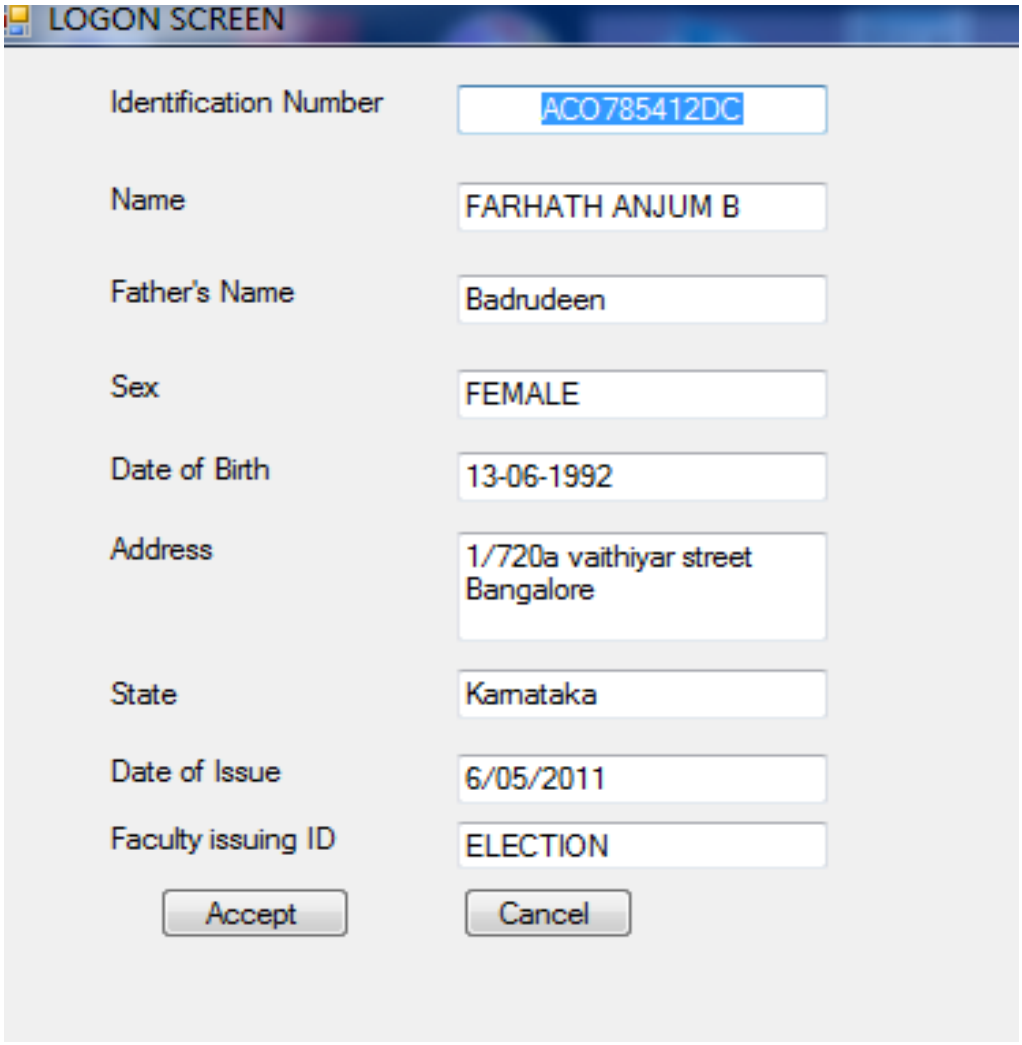
VII. RESULTS

Election officer must enter the password and the corresponding state of the voters for verification.

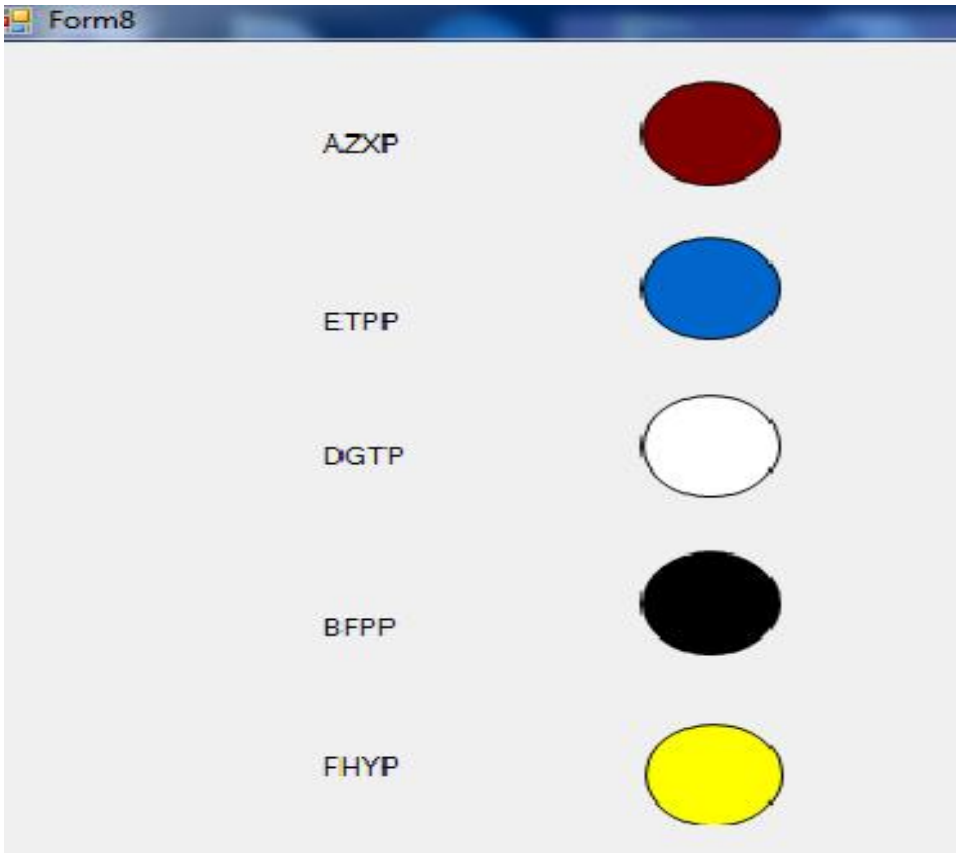
After login voter must authenticate it for security purpose.



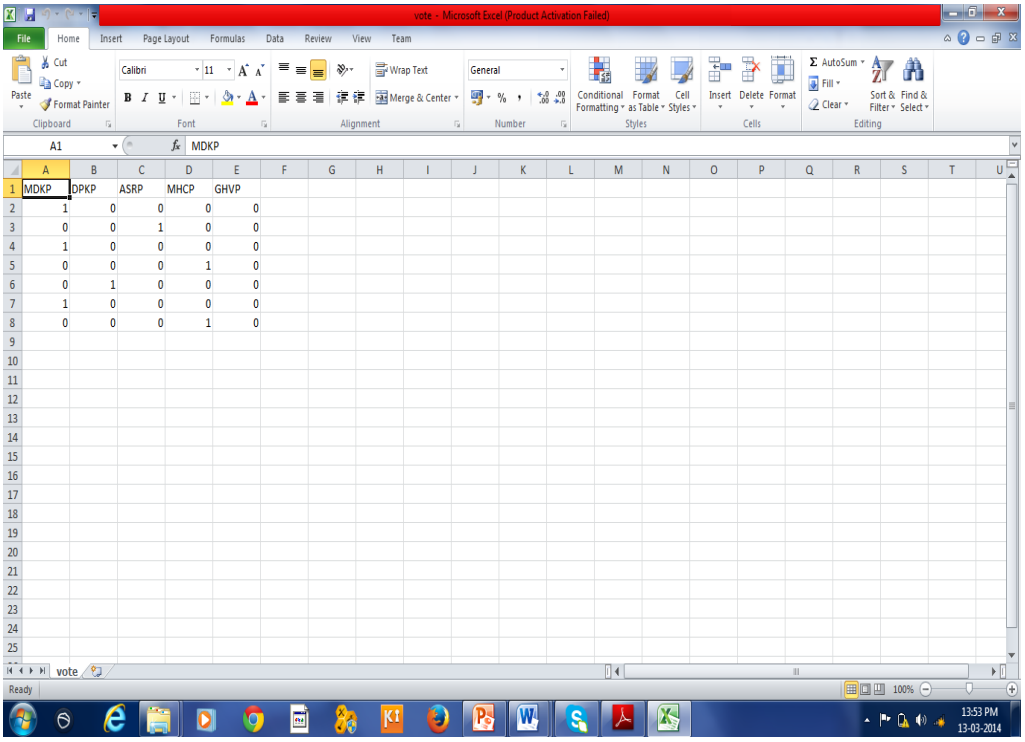
If the voter belong to that state then the person details will be displayed in a system which is already stored in databases.



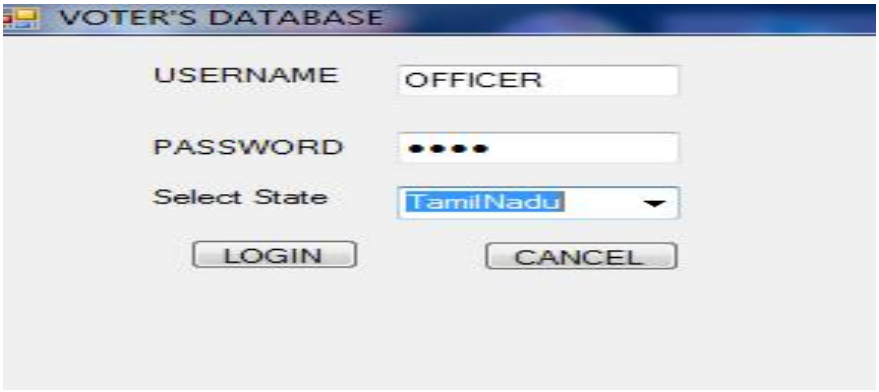
If the details are correct then voter must accept it. After then election symbol of the particular state will be displayed.

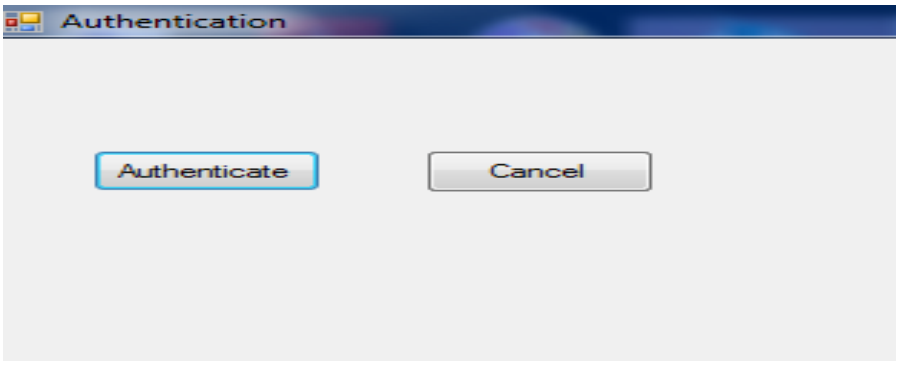


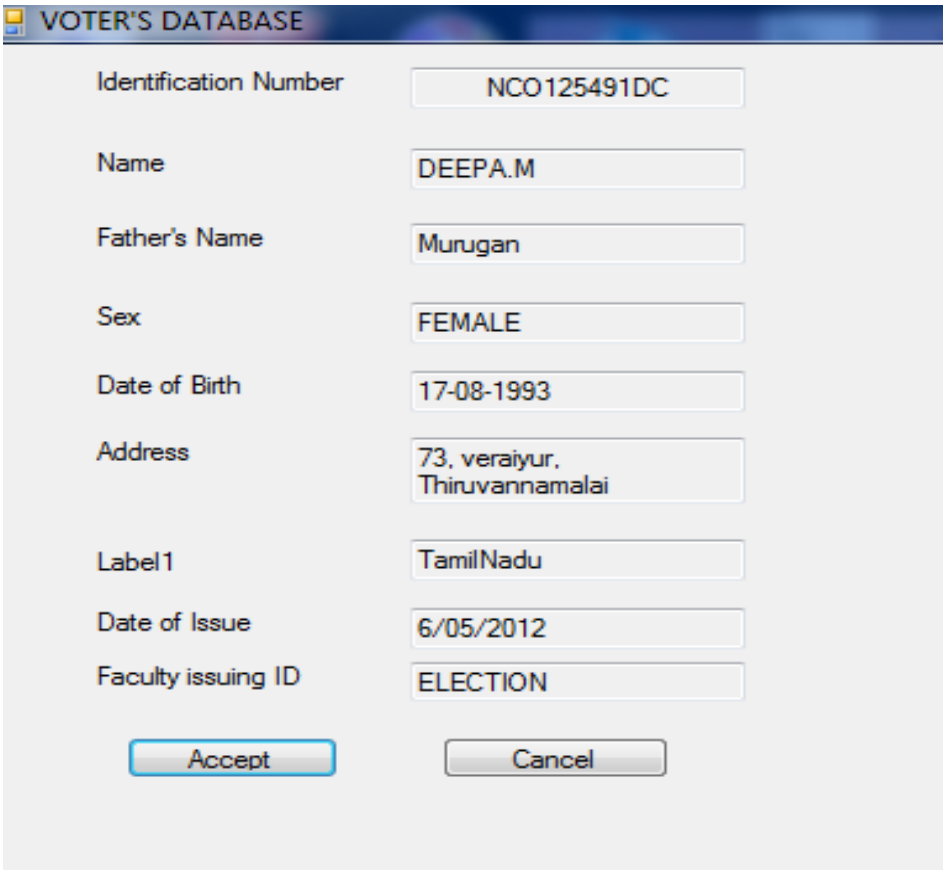
Voters can select the symbol andcast their votes to the particular party.
After polling results are stored in the databases.

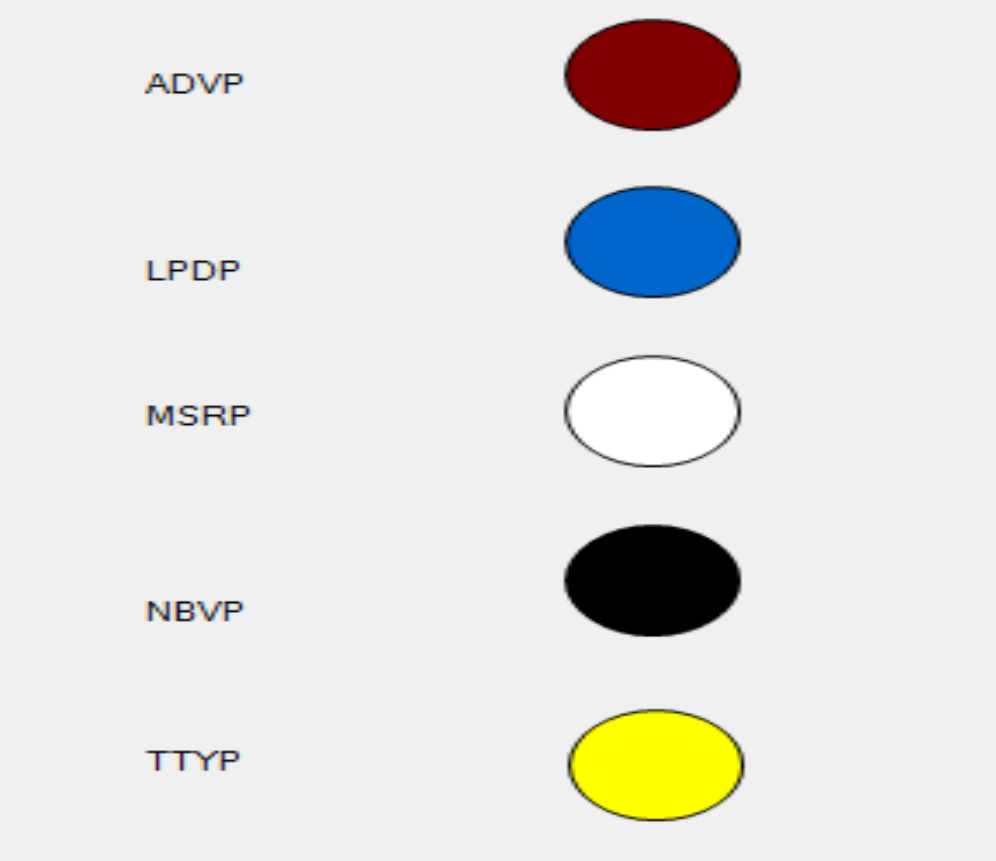


Similarly for another state ,





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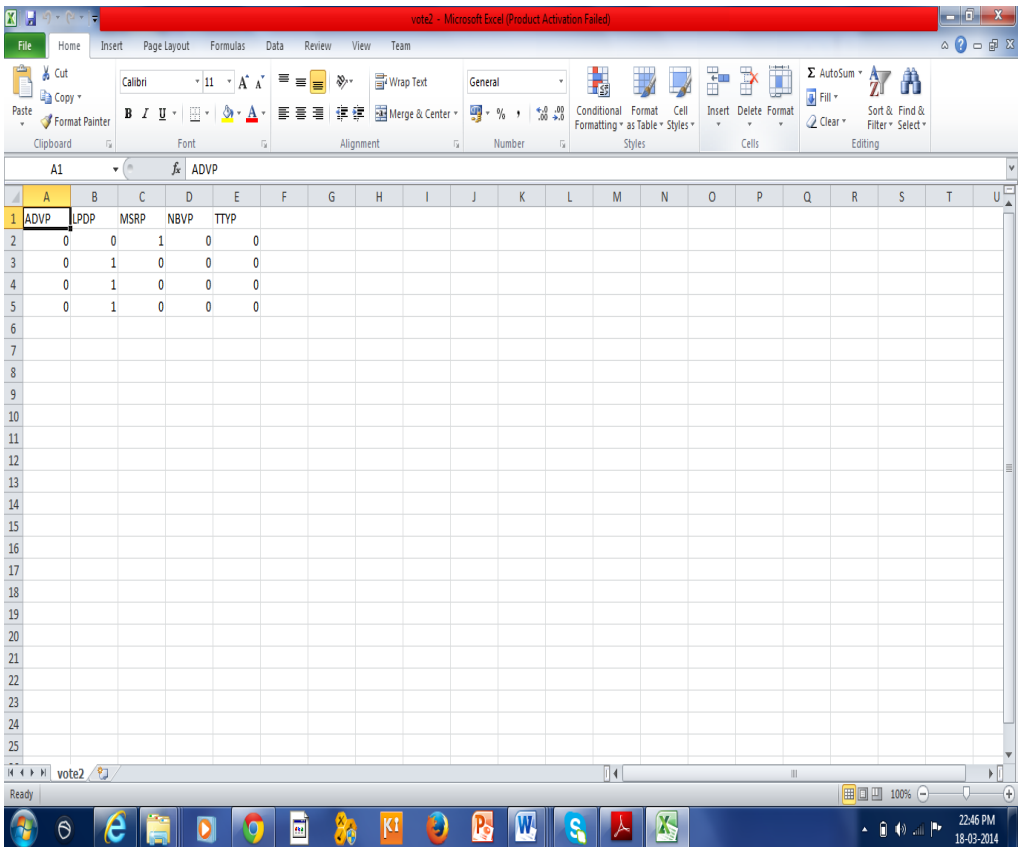
LPDP
MSRP
NBVP
TTYP


vote2 - Microsoft Excel (Product Activation Failed)
ADVP LPDP MSRP NBVP TTYP
0 0 1 0 0
0 1 0 0 0
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vote2
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18-03-2014

VIII. CONCLUSION

In olden days, polling is done more manually using ballot boxes and papers. As the world got modernized and automation came in to effect, it has been changed to Electronic Voting Machines. Bio-metric EVM may be considered as its updation. Yet more improvements can be made as science advances. Memory of finger print module can be expanded .We can use a 1mb flash memory finger print module for increasing the capacity.External memory can be provided for storing the finger print image, which can be later accessed for comparison.Smart Card reader module is supposed to be introduced with the existing module for further security, and to reduce the database storage.Audio output can be introduced to make it user friendly for illiterate voters.Retina scanning can also be developed.

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