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Analysis of Microcontroller in Electronic Voting Machine (EVM)

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Abstract: **This Paper gives an insight on working of an Electronic Voting Machine more commonly known as EVM, India is a democratic country in which every citizen has the right to vote. People exercise their right to vote by simply pressing a button indicating their favoured candidate on this machine, but even if this procedure may look simple behind this secrecy of casting vote, being accurate and transparency the few aspects are important for an EVM. As people choose their fate by means of this EVM. The Election Commission of India has the responsibility to carry out the Elections in free and fair manner. The EVM makes this tedious process simpler as it makes the counting of votes faster and accurate reducing Human Error and thus helps the Citizens of India in choosing their Government.**

Keywords: **Electronic Voting Machine(EVM), Microcontroller 8051, Microcontroller AT89S51, AVR Microcontroller, PIC Microcontroller.**

1. INTRODUCTION

India is the largest democratic country in the world. Active involvement of the public in the formation of the government is an essential aspect of a democratic government. This is confirmed by an election. Conducting elections in a populated country like India is a difficult task. It's a test to conduct elections for collection of candidates to signify the people of the country at different levels. Even more important is the timely announcement of results. This is required to bring steadiness in the governance and stable financial growth of the nation. To overcome this problem, an EVM (Electronic Voting Machine) is an answer to all these complications. In the worldwide, several countries have shown their interest in learning the mechanism behind this powerful machine. It's got a very simple interface, its tamper proof, avoids the fake voting and it has helped in receiving rid of the time-consuming duty of counting.

The term EVM or electronic voting machine was designed by the election commission of India in association with two public sector undertakings BEL, Bangalore and ECIL, Hyderabad. In the year 1982 these devices were first used in the by-election to the

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Assembly Constituency of Prarur, Kerala for fifty polling stations. EVM's make polling much faster and also more reliable than ballot papers, by avoiding bogus voting to a great range. The electronic voting machine saves time, money and manpower. It helps in keeping the secrecy of voting data. At the end of the elections, you can check the result by pressing a button.

2. MICROCONTROLLER 8051

The Electronic Voting Machine uses Microcontroller 8051as its brain. This types of EVMare designed for Eight contestants. Voters can poll their vote to any one of the contestant. In this EVM one port is dedicated for push button switches for eight contestants, master switch for polling officer.

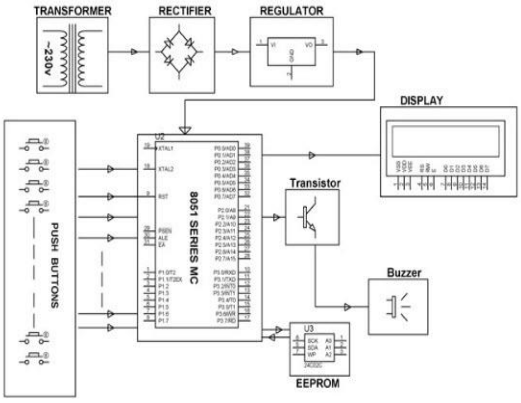

Figure 1: Block Diagram for EVM with Microcontroller8051

(Courtesy: edgefxkits.com)

SYSTEM ARCHITECTURE

The Electronic Voting Machine is built with transformer (230 – 12 V AC), voltage regulator (LM 7805), rectifier, filter, microcontroller (at89s52/at89c51), led, push buttons, buzzers, BC547, 1n4007, resistor and capacitor.

A. Power Supply

The 230V AC power supply is the first step down to 12V AC using a step-down transformer. This is then converted to the DC using a bridge rectifier. The AC ripples are filtered out by using a capacitor and given to the input pin of the voltage regulator 7805.At the output pin of this regulator, we get a constant 5V DC which is used for MC and other ICs in this project.

B. Microcontroller

It is a smaller computer and it has on-chip RAM, ROM, I/O ports Features of AT89S51/52 includes the following.

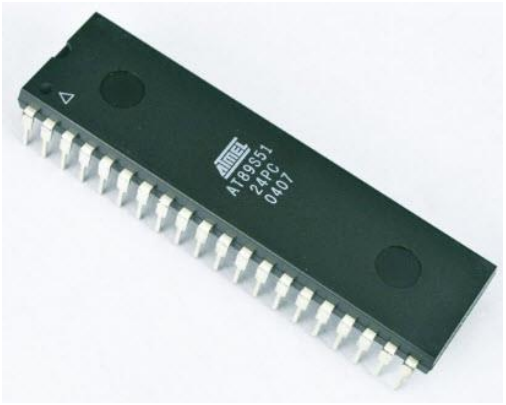

Figure 2: Microcontroller AT89S51

(Courtesy: pantechsolutions.net)

- Compatible with MCS®-51 Products
- 8K Bytes of In-System Programmable (ISP) Flash Memory
- Endurance: 10,000 Write/Erase Cycles
- 4.0V to 5.5V Operating Range
- Fully Static Operation: 0 Hz to 33 MHz
- 256 x 8-bit Internal RAM
- 32 Programmable I/O Lines
- Three 16-bit Timer/Counters
- Eight Interrupt Sources
- Full Duplex UART Serial Channel
- Interrupt Recovery from Power-down Mode
- Watchdog Timer
- Dual Data Pointer

C. LEDS

LEDs are semiconductor devices that are made out of silicon,when current passes through the LED, it emits photons as a by-product. Normal light bulbs produce light by heating a metal filament until its white hot. LEDs present many advantages over traditional light sources, including lower energy consumption, longer lifetime, improved robustness, smaller size and faster switching.

D. Piezo Buzzer

This buzzer is a piece type audio signaling device, which has a piece element and a oscillating circuit inside which oscillates the piezo brass base plate, which when given voltage difference produces the sound of a predefined frequency.

- These high reliability piezo buzzers are applicable to general electronics equipment. Compact, pin terminal type Piezo buzzer with 4 KHz output.

- Pin type terminal construction enables direct mounting onto printed circuit boards.

E. BC547 Transistor

The BC547 transistor is an NPN Epitaxial Silicon Transistor. The BC547 transistor is a general-purpose transistor in small plastic packages. It is used in general-purpose switching and amplification BC847/BC547 series 45 V, 100 mA NPN general-purpose transistors. Whenever base is high, then current starts flowing through the base and emitter and after that only current will pass from collector to emitter.

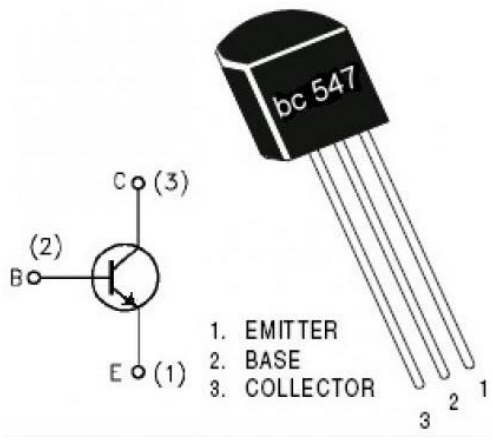

Figure 3: BC547 Transistor

(Courtesy: potentiallabs.com)

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3. MICROCONTROLLER AVR

An electronic voting machine based on ATmega16A microcontroller.

To cast a vote, users need to press the key against the name of the candidate of their choice. The vote is automatically saved in the microcontroller, and simultaneously the LCD shows the message "Thank You."

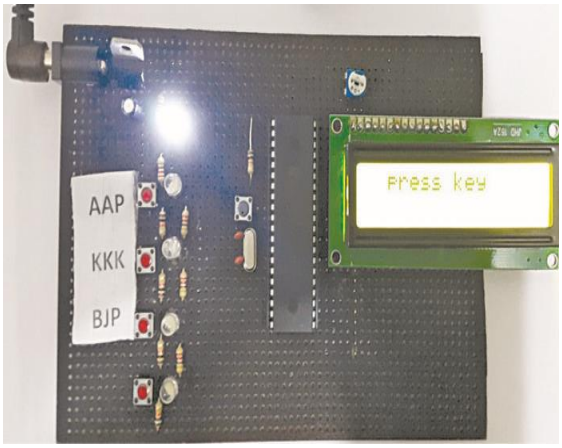

Figure 4: Prototype of EVM with AVR Microcontroller

(Courtesy: electroniceforu.com)

SYSTEM ARCHITECTURE

A. Circuit and Working

The circuit of the electronic voting machine is built around ATmega16A microcontroller (IC2), IC 7805 (IC1), a 16×2 LCD (LCD1) and other associated components.

The controller used here operates off 5V DC supply. So a 7805 voltage regulator IC is used to step 9V DC down to 5V. Capacitors C1 and C2 are used to reduce ripples. ATmega16A has 32 general purpose input/output (I/O) pins. An external 8MHz crystal oscillator is used to provide the timing pulse. Four switches (S1 through S4) are connected to Port B (PB0, PB1, PB2 and PB3) of IC2.

The LCD (LCD1) operates in 4-bit mode. Its data pins (D4, D5, D6 and D7) are connected to Port A (PA2, PA3, PA4 and PA5) of IC2. Control pins RS and EN are connected to pins PA0 and PA1 of IC2, respectively.

The LCD displays each character in a 5×7-pixel matrix. You can adjust the contrast of the LCD using a 10-kilo-ohm preset. While programming ATmega16A, note the fuse bit settings. Low fuse bit value is E4 and high fuse bit value is D9.

B. Software

The software is written in 'C' language and compiled using Keil software. You can use any suitable software for programming the ATmega16A microcontroller. ProgISP programmer was used for programming at EFY Lab.

C. Assembly Testing

After assembling the circuit on the PCB, check it for proper connections. Now, burn the program (voting code. Hex) into the microcontroller using the programmer. Insert the microcontroller into the IC base and connect 9V battery. LCD1 will show "press any key" message.

This circuit has provision to cast votes for three candidates as it uses switches corresponding to three candidates only (S1 for AAP, S2 for KKK and S3 for BJP). Switch S4 is pressed to calculate the results.

When you press any of switches S1 through S3, the corresponding pin of the microcontroller gets pulled up to Vcc and it operates as per the programmed logic. The LCD1 will show a "Thank you" message. The respective LED (LED1-LED3) must glow to indicate that voting is successful.

Press switch S4 to get results like the winner and its share of the votes. In case two or more parties get equal votes, press switch S4 again to get further details.

Parts List of EVM with AVR controller: -

Semiconductors:

IC1 – 7805, 5V voltage regulator

IC2 – Atmega16A microcontroller

LED1-LED5 – 5mm LED

Resistors (all1/4-watt, ±5% carbon):

R1, R6-R9 – 220-ohm

R2-R5, R10 – 10-kilo-ohm

VR1 - 10-kilo-ohm preset

Capacitors:

C1 - 100µF, 25V electrolytic

C2 - 10µF, 16V electrolytic

C3, C4 – 22pF Ceramic disc

Miscellaneous:

CON1 –2-pin terminal connector

S1-S5 – Tactile switch

LCD1 – 16x2 LCD

XTAL1 – 8MHz crystal oscillator

- 40-pin IC base for ATmega 16A

- 9V battery

4. PIC MICROCONTROLLER

These Electron Voting Machine uses Microcontroller PIC as its brain.TheseEVMs are designed for eight contestants but are expandable to more than eight contestants. Voters can poll their vote to any one of the contestant.

In this project one port is dedicated for push button switches for eight contestants and a master switch for polling officer. A simple yet powerful program is written in assembly language and is burned onto the microcontroller to accept votes and to retain the total number of votes polled.

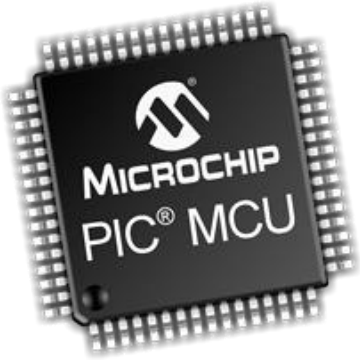

Figure 5: Actual picture of PIC Microcontroller

(Courtesy: microchip.com)

Polling officer switch (master switch) is provided to avoid multiple polling of single voter. Every voter should get approval from the polling officer. If the polling officer issues approval with his control switch, then only a voter can poll his vote.

This issuance of approval is indicated by an long buzzer beep. Vote count is stored in EEPROM space of PIC microcontroller which is inbuilt in PIC and an LCD display is provided to display the total number of votes polled and individual contestant-vise votes polled. An erase button is also provided in order to make sure the contents of the EEPROM is zeroed before the start of the polling process.

A buzzer is provided for audio effect of switch bounce. Whenever a switch is bounced, the system acknowledges the bounce by a short beep sound. This buzzer is driven by an NPN transistor. If voter tried to multiple polling a long beep sound is generated.

SYSTEM ARCHITECTURE

PIC (Peripheral Interface Controller) is world's smallest microcontroller that can be programmed to carry out a vast range of tasks.

PIC microcontroller is an ICand its architecture comprises of CPU, RAM, ROM, TIMERS, PROTOCOLS, like SPI, UART, CAN which are used as interfacing peripherals.

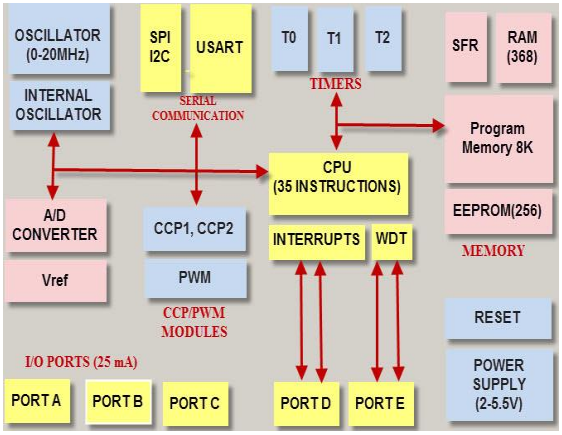

Figure 6: Architecture for PIC controller

(Courtesy: edgefx.in)

A. I/O Ports

The PIC microcontroller consists of 5-ports, namely Port A, Port B, Port C, Port D, Port E.

B. Timers/counters

PIC microcontrollers has four timers/counters. Timers areused for generating accuracy actions.

C. Interrupts

PIC microcontroller consists of 20 internal and 3 external interrupt sources which are allied with different peripherals like USART, ADC, Timers and so on.

D. Future Advancements

Further the project can be extended by adding a GSM/WIFI module which eases the operation of voting by sending a simple SMS over the network or access through a webpage over internet network.

5. CONCLUSION

In this paper, we propose the system architecture of EVMs, Electronic Voting Machines by doing analysis of EVMs with respect to three different microcontrollers namely 8051, AVR, PIC.It can be seen that microcontroller 8051 is one of the basic types of microcontrollers developed by Intel in 1980's., Whereas microntroller is comparatively new as compared to

8051 and AVR. Microcontrollers 8051 and AVR are 8 bits whereas PIC is available in 8 bits, 16 bits, 32 bits. In case of RAM, 8051 is available in 128 bytes, whereas AVR ranges between 32bytes to 32 kilobytes, but in case of PVR it is available in 368bytes. At last, if we compare them in terms of ROM then it can be observed that 8051 ranges from 4 kbytes to 6 kbytes, in AVR it ranges from 32 bytes to 4 kybtes, but PIC varies from other as it has EEPROM (EEPROM stands for Electrically Programable Read-Only Memory)of 256 bytes.

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